UPPER WILLIAMSON RIVER WATERSHED ANALYSIS

Chiloquin and Chemult Ranger Districts

Winema National Forest

August, 1996

WATERSHED ANALYSIS TEAM

The following persons were assigned the task of gathering available information, researching local knowledge of the watersheds through local publics, and evaluating conditions on-site. Together, as a team, they have worked to assimilate the information necessary to prepare this report.

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Special thanks to the following individuals for their assistance, input or technical knowledge. Their contributions helped make this report possible.

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Tuffy Eggsman, Chiloquin R.D., ditto.
Wanda Bennett, S.O., for also assisting with GIS work.

There are no doubt some that I forgot, but thanks to all that helped.

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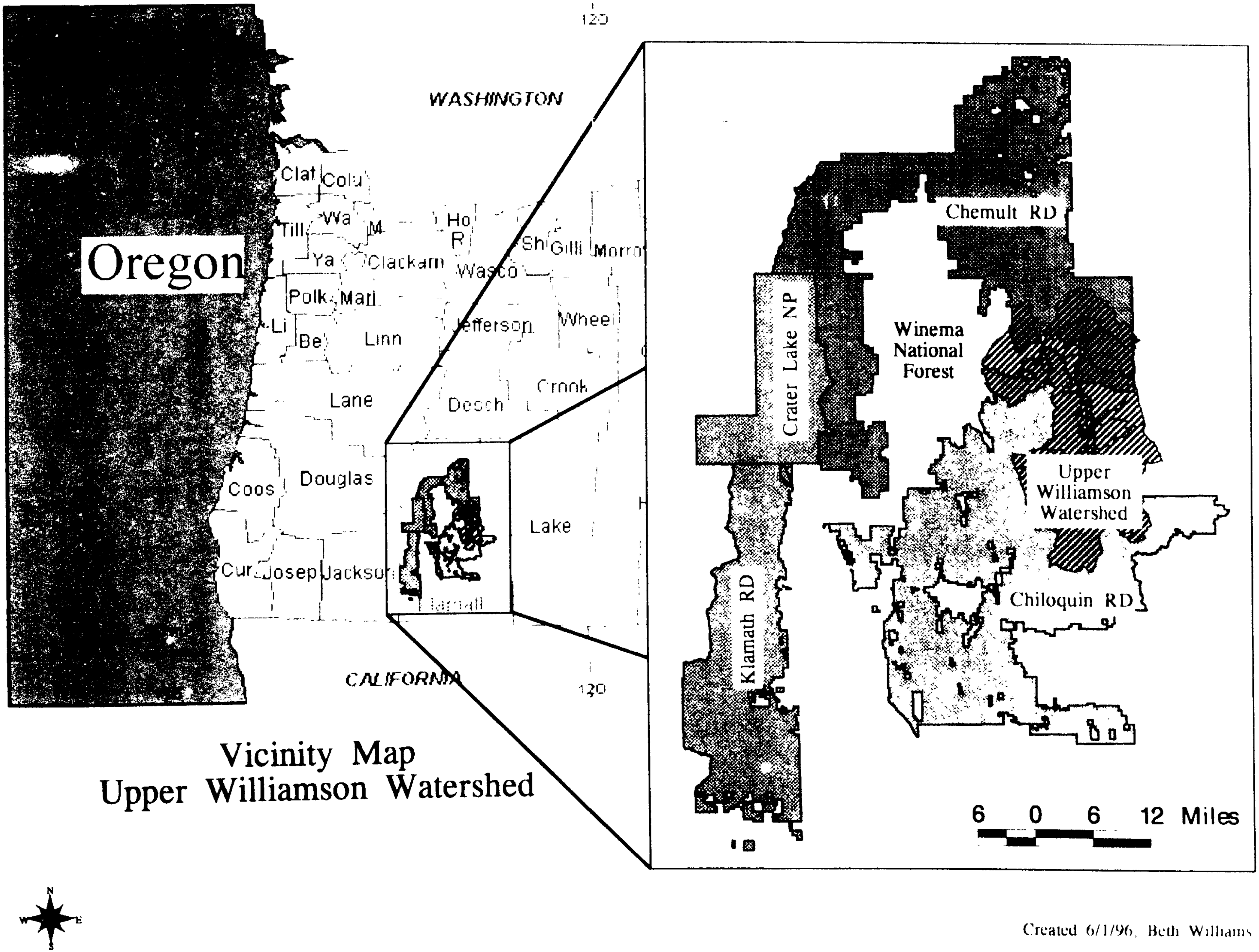


Vicinity Map
Upper Williamson Watershed

Created 6/1/96, Beth Williams

INTRODUCTION

The intent of this assessment is to provide a general description of ecosystem structure, processes, and functions occurring within the Upper Williamson Watershed. The analysis area includes 137,306 acres of Winema National Forest land, 16,233 acres of private land, 39,001 acres of Weyerhaeuser and 7,703 acres of State Forest land, for a total of 200,243 acres. Understanding the past, present, and possible future of the vegetation, riparian communities, wildlife, and other ecosystem components will help identify the potential and limitations of the watersheds involved in this analysis.

This assessment is a blend of current scientific knowledge, information gathered during on-site visits, interviews with local publics familiar with the area, and a review of existing records and documents . New inventories and surveys to fill gaps in existing information will be added to future updates.

This is not a decision document. It will neither resolve issues, nor provide answers to specific policy questions. This document is prepared to provide a foundation for project level analysis and support the line officer in decision making.

This assessment is a blend of formats used in previous analyses, and the format described in the Ecosystem Analysis at the Watershed Scale, Federal Guide for Watershed Analysis, Version 2.2 (hereinafter referred to as "the Guide" because it's such a mouthful). We have focused on the issues defined by the Chiloquin District Ranger, while following the format suggested by the Guide. Issues were identified under each core topic defined in the Guide (a soils section was added), and were addressed in the core questions also found in the Guide. In some cases lack of existing information, time constraints, etc., limited our ability to address all issues in a comprehensive manner, but the majority of the issues are addressed. The District Ranger requested that the assessment team focus on the following issues:

EROSION PROCESSES

Issue - Although not a major issue in this study area, the following erosion factors are addressed as contributors to erosion in the watershed:

1. Road systems
2. Downcutting channels
3. Wind erosion following wildfires
4. Compaction (variety of sources that may cause increased erosion.

HYDROLOGY AND STREAM CHANNELS

(The team felt that these two topics are interconnected and should be addressed jointly)

Issue - The hydrologic function of the upper Williamson River has changed over time, resulting in less water being retained in the system later in the year.

Key Questions

1. Do harvest practices adversely affect water yield?
2. How has grazing affected stream channel conditions?
3. How have water rights of private land-owners affected water yield, and timing and duration of downstream flows?
4. To what extent have diversions, both public and private, affected the watershed?
5. How has road construction and use affected hydrologic function and stream channel conditions?

VEGETATION

Issue - The impact of human management activities have altered the vegetative component of the watershed from its reference condition.

Key Questions

1. How and why has the upland vegetation component changed?
2. How and why has the riparian vegetation component changed?

SOILS

Issue - Portions of the watershed have been subjected to activities that may have detrimental impacts to soils.

Key Questions

1. Which soils within the watershed are most and least susceptible to compaction?
2. To what extent has compaction occurred, and which areas are showing detrimental effects of compaction?
3. Is loss of growth due to compaction evident within the watershed?
4. Which soils are most and least susceptible to erosion?

WATER QUALITY

Issue - Water quality has been affected by increased human usage of the watershed.

Key Questions

1. Is the surface water system phosphorous or nitrogen limited?
2. Has surface water temperature in the system increased?
3. How have land management practices affected water quality?

SPECIES AND HABITAT

Issue - There has been a perceived reduction of fish and game species and their associated habitat

Key Questions

1. How have important species and their habitat been affected?
2. How have threatened and endangered species been affected?

HUMAN USES

Issue - Human use of the watershed has increased and will continue to increase in the future.

Key Question

1. What are the major human uses, or items of importance in the watershed, and how do they affect the watershed as a whole?

The team developed the key questions listed above to assist in addressing the issues.

In order for the assessment team to assess the condition, function and processes of the watersheds, two time frames were selected: pre-1875, and current. These time frames were selected because 1875 marks the approximate beginning of the Euro-american influence within the watershed, which changed the conditions and thereby the functions and processes.

OVERVIEW

The Williamson River study area includes all the lands that drain into the Williamson River above the Klamath Marsh, except for the previously completed Jack Creek study area. The area spans a broad elevation range, from a low of approximately 4,500 feet at Klamath Marsh, to a high of over 8,100 feet at the top of Yamsay Mountain. Only 8.5% of the area is above 6,000 feet in elevation. The bulk of these acres are on Yamsay Mountain and along the eastern boundary of the study area. These high elevation lands influence the climate of the study area, and the character of the streams that drain them. Many of the streams that drain these higher elevations have perennial flows. Over 58% of the study area is below 5,000 feet in elevation. These lands include the Williamson River Valley and the majority of the lands to the west. Perennial stream flow is absent from lands west of the river.

The topography of the study area is dominated by the broad Williamson River Valley and gently rolling ridges in the uplands. Approximately 93% of the area is composed of land forms with slopes of 20% or less. Of this, half have slopes of 5% or less. Yamsay Mountain and Booth Ridge, forming the eastern boundary of the study area, and Fuego Mountain in the south are notable exceptions to this subdued topography The 7% of the study area with slopes greater than 20% occur here. Streams that drain the steeper topography flow in narrow valleys confined in deeply incised canyons. The stream systems in the gently rolling topography are discontinuous channels located in nearly flat grassy meadows, broken by an occasional short, narrow canyon. The Williamson River is a highly sinuous perennial stream in a broad valley bottom. The river has been very dynamic, moving its channel back and forth across the valley floor, as evidenced by the many abandoned channel segments visible on aerial photographs.

Except for the top 1/2 of Yamsay Mountain, the study area has been heavily used for forestry and agricultural purposes. Nearly 69% of the study area is currently National Forest, all but 500 acres of which is administered by the Winema National Forest. Most of these lands are forested and were harvested by the Bureau of Indian Affairs starting in the early 1940's, and subsequently harvested multiple times by the Forest Service and private concerns. Over 19% is currently owned and managed by Weyerhaeuser Cooporation. These lands have been in continual use as industrial forest lands since 1929. Slightly over 8% of the study area is in other private ownership and managed primarily as farm and ranch lands. The bulk of these lands are in the Williamson River Valley, and could be considered as riparian and associated uplands. Perennial stream flows from the Yamsay Mountain highlands have in large been diverted for irrigation of these lands. Cattle grazing has been heavy and long term on all of Williamson River Valley lands. About 4% of the study in the vicinity of Klamath Marsh in owned and managed by the State of Oregon as forest lands.

There are 13 different Management Areas identified within the analysis area. They are:

01A	Yamsay Mountain Semiprimitive Recreation Area
02	Developed Recreation
03A	Scenic Management, Foreground Retention
03B	Scenic Management, Foreground Partial Retention
03C	Scenic Management, Middleground Partial Retention
07	Old-Growth Ecosystems

07OG Same as above, added after decision notice
08 Riparian Areas
09A Bald Eagle Nest Sites and Recovery Sites
09B Bald Eagle Replacement Habitat
12 Timber Production
13 Research Natural Areas
15 Upper Williamson

The Management Areas map following the table below identifies the location of each area. For a full description of the management objectives for each area see Appendix A, Management Areas.

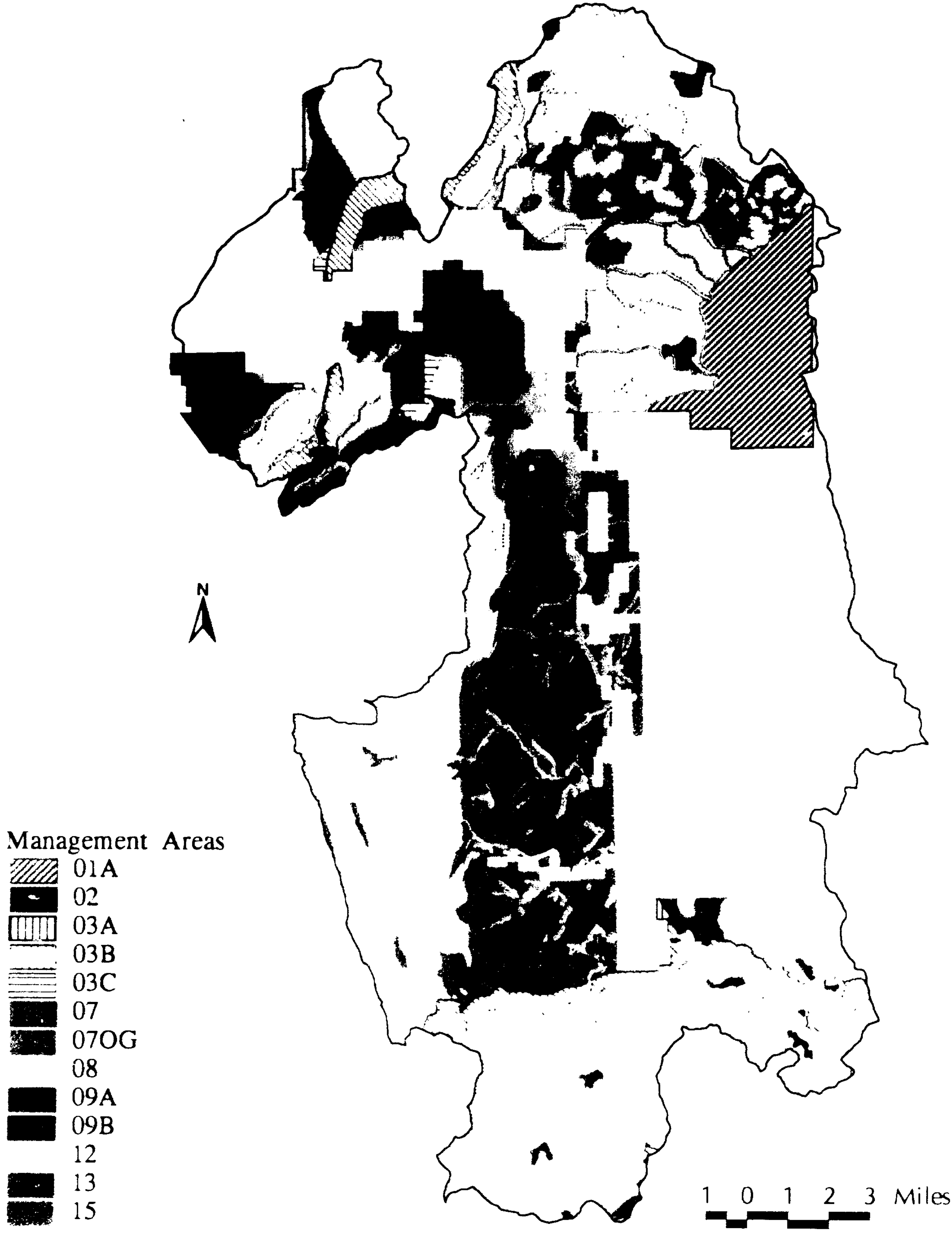
The table below provides a synopsis of major watershed characteristics.

UPPER WILLIAMSON RIVER WATERSHED CHARACTERISTICS

Watershed Characteristic	**Long Prairie**	**Jackson Creek**	**Deep Creek**	**Sand Creek**	**Williamson River Headwaters**	**Wildhorse Creek**	**Bull Pasture**	**Haystack**	**Williamson River**	**Williamson River at Marsh**
Total Acres	15,287	12,660	6,707	10,479	14,297	18,300	17,745	13,474	61,877	29,417
Total Stream Miles *miles*	31 3	45 5	16 6	24 1	33 7	14 7	20 5	29 3	158 3	40 6
Stream Density *miles/sq. mile*	1.3	2 3	1 6	1 5	1 5	0 5	0 7	1.4	1 6	0 9
Total Road Miles *miles*	118 9	60 4	22 7	36 7	83 7	149 2	134.4	91 8	379 2	131 3
Road Density *miles/sq. mile*	5 0	3 1	2 2	2 2	3 8	5 2	4 9	4 4	3 9	2 9
Stream and Road Intersections *No.*	60	36	4	3	36	11	12	18	95	22
Slope Classes *ac.*										
0 to 5%	7,315	1,832	945	2,862	7,283	6,079	8,681	6,884	27,188	23,442
6 to 20%	7,064	7,804	3,629	7,139	6,867	10,763	8,643	6,273	30,098	5,619
21 to 30%	741	1,901	1,400	454	124	1,142	361	301	3,412	293
30% +	166	1,122	733	24	23	316	60	17	1,178	63
Elevation Range										
Minimum *ft*	4,537	4,531	4,560	4,564	4,580	4,580	4 561	4,564	4,521	4,498
Maximun *ft*	7,162	8,133	8 156	6,670	6,277	6,857	5,827	5,571	8,104	5,026
=5000 ft							10,872	11,105	41,977	
5000 ft +							6,873	2,369		
-6000 ft	13,956	7,445	3,195	8,797	14,163	17 754			57,369	
6000 ft +	1,331	5,215	3,512	1,682	134	546			4,508	
Aspect Class *ac*										
North	3,131	3,502	615	2,206	3 153	5 791	6,252	3,272	11,255	6,745
East	1,182	644	488	1 368	1,215	6,216	6,771	5,122	8,674	4,320
South	3,045	1,372	1 629	2,541	3 933	2,291	2,192	3,530	13 097	4 709
West	6,878	7 068	4,012	4,350	5,844	3,851	2,340	1,493	27,189	8,414

Watershed Characteristic	Long Prairie	Jackson Creek	Deep Creek	Sand Creek	Williamson River Headwaters	Wildhorse Creek	Bull Pasture	Haystack	Williamson River	Williamson River at Marsh
Soil Types *ac*										
"A"	894	0	0	0	0	0	2 812	4.945	11,860	13,364
"B"	8.753	1,765	101	55	9,359	14,187	12,179	6,115	12.319	1,661
"G"	1,469	373	61	0	1,710	2,395	1,505	2,005	1,969	2,067
"H"	3,314	5,446	0	2	361	764	266	96	2.492	319
"R"	128	2,748	600	0	0	0	0	0	1.943	0
Other	342	792	26	12	10	42	0	1	1,293	565
Not Mapped	387	1,536	5,919	10,410	2,857	912	983	312	30,001	11,441
Geology *ac*										
Basalt/Andesite	9,375	9,924	6,135	9,756	13,630	15,402	10.579	3,516	28.159	7,889
Eruptive Centers	1,488	456	0	608	504	1,631	459	0	1,186	13
Mazama Pumice	0	0	0	0	0	0	0	0	1,871	2,370
Sediments	4,424	2,280	572	115	163	1,267	6,707	9,958	30,661	19,145
Vegetation *ac.*										
Forest Type	14,436	11,439	5,950	9.371	13,125	16,862	15,741	11,648	52,039	18,922
Shrubland	407	368	366	408	372	433	690	894	2,884	619
Grassland	338	799	271	556	604	865	841	509	5,606	9,628
Rock/Sparse	106	54	120	144	196	140	473	423	1,348	248
Riparian Veg *ac.*										
Forest Type	863	970	40	7	653	456	624	755	2,426	1,349
Shrub & Grass	269	681	32	4	70	238	209	290	3,585	9,590
Stream Veg *miles*										
Forest Type	29.7	36.1	13.1	18.9	26.4	13.0	14.4	20.3	104.9	7.8
Shrub & Grass	1.6	9.4	3.5	5.2	7.3	1.7	6.1	9.0	53.4	32.8
Ownership *ac*										
National Forest	15,118	11,315	878	69	11.816	17,658	16,768	13,114	32,151	18,419
Weyerhauser	0	0	5,615	10,280	1,903	0	0	0	21,203	0
Private	169	1,345	214	130	578	642	977	360	8,523	3,295
State Forest	0	0	0	0	0	0	0	0	0	7,703

Management Areas



I. EROSION PROCESSES

Step 1: What erosion processes are dominant within the watershed? Where have they occurred or are they likely to occur?

The dominant erosion processes in the upper Williamson watershed are stream bank erosion, and to a substantially lesser extent, erosion from road concentrated storm runoff and snowmelt, wind erosion after wildfires, and erosion exacerbated by compaction of soils.

The Forest's GIS data base shows 1,208 miles of road within the analysis area, for an average of 3.9 miles of road per square mile of land area, and many currently used roads are not yet in the data base. This is three times the stream density. The streams in the study area have been directly impacted (crossed or restricted) by the road system in over 200 specific locations. The majority of these impacts are roads crossing stream channels via an earthen fill and culvert. In some cases, low standard roads are located in ephemeral channels. The crossings with only one culvert to pass streamflow restrict the channel's ability to adjust within its valley to natural disturbances. In several cases this has resulted in incised channels both up and downstream of the culvert location. In most cases these disturbed channels are not extensive; however, the conditions remain unstable.

Several of the most obvious examples of these erosion processes occur in the low gradient grassy meadows of the Williamson River Valley and the tributary systems west of the river. Examples of areas with stream bank erosion due to downcut channels, and the major contributing factors are as follows:

- Telephone Draw, Haystack Draw, Bull Pasture - heavy off-road vehicle use, historic livestock trails, roads, culverts
- Williamson River on private lands - ditches, irrigation dams, livestock use, trails, etc.
- Royce Tract - off-road vehicle use, dispersed camping
- Rocky Ford - historic railroad grade construction, historic livestock trails, dispersed camping, off-road vehicle use
- Jackson Creek - off-road vehicle use, roads, dispersed camping, historic sheep trails
- Modoc Creek, Aspen Creek, Deep Creek - roads, culverts, past and present livestock use, diversions

Over 1,200 miles of roads crisscross the study area. Erosion processes associated with roads include

- ☹ dredging, narrowing, straightening, or ditching during original road construction to match channels to road designs
- ☹ concentration of storm runoff in road ditches and on road surfaces
- ☹ interception and concentration of groundwater in road ditches
- ☹ constriction of stream channels by road fills and culverts
- ☹ Water becoming ponded around culverts, then receiving heavy livestock and big game use in late summer, which removes deep rooted vegetation and exposes soils to potential winter rain/snow events.

Of these, reforming stream channels and constriction of channels by road fills are the most common. examples of each can be found in the Telephone Draw and Bull Pasture areas

Areas within the Upper Williamson Watershed that are most prone to wildfire-induced wind erosion include:

- the western, lower slopes of Yamsay Mountain, from T. 30 S., R 11 E., section 8 south to T. 31 S., R 11 E. section 8
- the western slopes on the east side of the Upper Klamath Marsh between the Military Crossing Road (FS Road 7630) and the Silver Lake Road (FS Road 76), in T. 31 S., R 9 E
- the slope above Telephone Draw at T. 32 S., R.10 E., northern half of township
- most of township 33 S., R. 10 E
- Taylor Butte at T. 33 S., R. 11 E., sections 17, 20, and 21
- the northern, lower slopes of Fuego Mountain at T. 33 S., R. 11 E., sections 30, 31, and 32; and T. 34 S., R. 11 E., sections 5, 6, 7, and 8

Step 2: What are the current conditions and trends of the dominant erosion processes prevalent in the watershed?

Road Systems

Over 90% of the roads in the study area are in soil types "A" and "B", with road gradients in the 0% to 2% range. Storm runoff from these roads is minimal and infiltration rates are generally high enough to eliminate overland flow, except in the most extreme cases. Storm runoff down road surfaces or in roadside ditches may occur during rapid snowmelt or intense summer thunder storms, on short pitches of road with grades in the 5% to 6% range. Significant erosion damage is rarely a result.

Roads located in the "G" type (meadow) soils often function as artificial stream channels, and have at times caused accelerated erosion rates and unstable channel conditions. Approximately 60 miles of Forest System roads occur within the "G" soil type. The majority of these miles are roads that cross meadow systems perpendicular to the run of the meadow. These road segments generally consist of fills on top of meadow surfaces, and do not function as stream channels. They do tend to concentrate surface flow to culvert locations, and may increase water velocities, causing accelerated erosion rates near the culverts.

However, the bulk of the roads within the meadow systems of the study area are not Forest System roads, but rather roads created by hunters and wood cutters. These routes tend to run the length of the meadows and have in several cases been a factor in the start of channel destabilization processes. Because of the low gradient of the meadows, and the intermittent and ephemeral nature of the stream systems involved, the destabilized channel segments are relatively short and discontinuous and do not alter the overall function of the system.

Downcutting and Eroding Channels

The stream systems that drain Yamsay Mountain and Booth Ridge to the east of the Williamson River are largely confined in narrow, incised valleys with "A" and "B" channel types. These channel types are generally very stable, and currently show no signs of downcutting. Where these channels meet the Williamson River Valley, they flow out of their confining canyons onto valley sediments. Some of these more sensitive channels do show signs of downcutting. The causes are likely complex, a combination of heavy agricultural use, effects of roads and railroad grades, and the possible lowering of the base level of the Williamson River since the turn of the century. Overall, the stream systems east of the Williamson River are currently stable.

The stream systems west of the Williamson River are low gradient intermittent and ephemeral drainages with discontinuous channels. Segments of these systems have short and discontinuous downcut channels. Examples are Haystack Draw, Telephone Draw, and the Bull Pasture systems. These downcut segments appear to have been in place for several decades and have begun to stabilize in recent years. The low gradient and discontinuous nature of the channels in these systems does not allow sediments generated from the downcutting to progress through the system. Sediments are deposited immediately downstream of the channel cutting and are incorporated into the meadows. The causes of the downcut channel segments appear to be a combination of vehicle traffic in the meadows, heavy domestic grazing use, major storm events (1964), and concentrations of surface flow by road fills and culverts. In general, the stream systems west of the Williamson River are currently stable or in an upward trend. The downcut channel segments have localized effects, but have no significant effect to the overall function of the systems.

The Williamson River appears to have downcut 4 to 5 feet into its valley from below a natural reef near the mouth of Sand Creek, all the way to the Klamath Marsh. The entrenchment os most noticeable below Rocky Ford. It is speculated that the primary driver for this downcutting has been a lowering of the level of the Klamath Marsh over the past 100 years. Heavy use of the river valley and bank area by domestic livestock has contributed to accelerated erosion rates. This erosion appears to contribute to the lateral migration of the channel, more than the continued downcutting. The current river condition below Sand Creek is intermittently unstable. The river bank is very active in many segments, supplying significant amounts of

Actively eroding channel banks at Rocky Ford, aggravated by past intense grazing pressure.

sediment to the channel on an annual basis. Stream banks are often lacking stabilizing vegetation, and are likely to remain subject to accelerated erosion rates for many years to come.

Above Rocky Ford, the relationship between the water level in the channel and the valley floor appears to be more consistent with the channel type. Flood waters have access to the full valley floor, where below the ford, flood waters are confined within the entrenched channel. The river above the reef is, however, generally devoid of stabilizing channel bank vegetation, and natural flows have been heavily modified by dams and irrigation diversions. The connection between the channel and its flood plain is largely artificially controlled in this reach.

Wind Erosion Following Wildfires

Soil organic layers that are partially or totally burned by wildfire are susceptible to wind erosion. This type of erosion occurs during and immediately after all wildfires. The amount of soil and nutrient loss is related to the severity of the burn, exposure of the site (to wind), amount of time that elapses between the fire occurrence and precipitation, and soil type.

Burn severity (as it relates to soils) is a measure of the depth of the heat flux. This is largely determined by the duration of the smoldering phase of combustion, which, in turn, is related to the total surface fuel loading. Large, downed logs, stumps, root wads, and deep litter layers all provide sufficient fuel to support long-duration (several hours to several days) smoldering combustion. Heat fluxes from smoldering logs often burn all of the litter and organic layers. The loss of the litter layer and organic soil horizon results in a surface soil structure that is easily blown away. In addition to wind erosion of soil particles, this extended duration heating has been shown to impart levels of heat sufficient to volatilize nitrogen (and other organic and mineralized nutrients) at depths of over 12 inches below the surface. As the nutrient elements are volatilized and driven upward, they too are subject to wind transport off-site.

Ridgetops, saddles, long slopes, and other topographic areas that are more directly exposed to wind will exhibit greater losses from wind erosion than those areas not as directly exposed to wind. In addition, large bared areas (more than 100 acres) that are exposed to the predominant winds (generally southerly to westerly aspects) have increased wind erosion potential.

Early season fires generally provide more opportunity for wind erosion than late season fires. Burned areas generally receive more solar heating than unburned areas. Increased solar heating is associated with stronger convective winds and with dust devil generation. Both types of air movement will transport recently burned soil off-site.

Pumice soils generally exhibit less resistance to wildfire-induced wind erosion than clay soils. Pumice soils have less natural cohesion and much lower bulk densities. Consequently, they are more readily lofted into the air and transported downwind.

Compaction

The only obvious locations encountered in the study area where soil compaction has resulted in accelerated erosion, are meadows that have been heavily impacted by domestic livestock or vehicle use. In many cases this has led to channelization of surface water flow where there was none before, or downcutting of existing channels This has contributed to loss of water retention capabilities and increased soil movement through the meadows affected.

Step 3: What are the historical erosion processes within the watershed? Where have they occurred?

The primary erosion process prior to the aggressive management of the timber and grazing resources was, as it is today, stream bank erosion. The major difference is the rate of erosion. Stream bank vegetation is assumed to have been more continuous, with deep rooted species such as willow more common. Aggressively eroding stream banks, although present, are assumed to have been short discontinuous sections, with little overall effect on the system as a whole.

The meadows of the study area were well vegetated, with native grass species supplying a well formed root mass, protecting the soil from the erosive forces of major storm events.

Accelerated erosion rates were associated with the natural disturbances of fire and drought. The overall impact of these events are assumed to be less frequent and less intense than the modern disturbances of timber harvest, grazing, and road construction.

Step 4: What are the natural and human causes of changes between historical and current erosion processes in the watershed? What are the influences and relationships between erosion processes and other ecosystem processes?

The types of erosion processes have not changed significantly between the pre-resource utilization period and the present time. The major change has been in the rate of erosion. Grazing, logging, and firewood gathering activities and associated road systems have served to reduce stabilizing vegetation along stream banks and in meadow system riparian areas, in some cases concentrating runoff flows. This has allowed the erosion process to accelerate. Continued disturbance events from regular use of the land have slowed or delayed the natural recovery of the drainage system to pre-disturbance levels.

The accelerated erosion rates of the Williamson River and its tributaries directly add sediment to the river, affecting aquatic habitat conditions. Erosion of the river banks reduce hiding and thermal cover for fish and may smother aquatic plants. Sediment levels in excess of the river's ability to carry will tend to retard the recovery of the system to a more stable condition. This condition can be seen in the river segment around Rocky Ford.

Accelerated erosion in meadows, that results in entrenched channel segments, locally lowers the water table or accelerates the seasonal lowering, possibly resulting in vegetation changes over the extent of the affected meadow. This may include changes in grass species, a narrowing of the meadow due to conifer encroachment, or in the extreme case, the slow conversion of the entire site to a conifer forest or dry site brush type.

Recommendations

Roads

Identify all locations where system roads are located within riparian zones and meadows. Where signs of accelerated erosion is present, evaluate the opportunity to first remove the road, second reduce the water energy causing the erosion, and third retard the accelerated erosion with vegetation or other materials. Where the road has restricted the passage of flood level flows to one location (single culvert), consider developing additional flow paths to allow utilization of the entire flood plain above and below the road fill. Where hunters and wood cutters have created non-system roads running the length of the meadow systems, consider barring future vehicle access and relieving the soil compaction where meadow vegetation has been eliminated. These cases primarily exist in the Williamson River Valley and in the drainage systems to the west of the River.

Consult with Engineering to devise a feasible method of road construction that will allow water to pass through or under roads at multiple locations to allow natural adjustments to occur.

Downcut Channels

Priority should be given to stabilization of the actively eroding banks of the Williamson River and those segments of tributaries that are directly adding elevated sediment levels to the river.

Bull Pasture Watershed Improvement Project. Lodgepole pine placed along creek bank to keep cattle from further breaking down channel bank.

The Williamson River, between Sand Creek reef and Klamath Marsh, has many actively eroding channel banks. Restoration activities along the river should focus on excluding grazing livestock from the channel banks and reestablishing stabilizing vegetation. In most cases this will require the cooperation of private land owners.

The significant segments of tributaries with entrenched and unstable channels are located in the Telephone Draw, Haystack Draw, and Bull Pasture systems. The segments appear to be improving, after several years without livestock grazing and placement of erosion control structures in some of the more critical areas. Additional actions to support healing of these channel segment should focus first on removing potential sources of impact (poor road placement and drainage design, off-road vehicle use, livestock grazing), and second, on aiding the establishment of stabilizing vegetation. Priority should be focused on channel segments that directly affect the Williamson River.

National Forest holdings along the river should be used as test sites to develop the most efficient way to reestablish willow and sedge growth on the raw, actively eroding channel banks. The proven process can then be shown to private land owners to gain their cooperation in expanding restoration projects along the full length of the river.

Soil Compaction

Mitigation of soil compaction for the benefit of hydrologic function is generally not necessary within the study area. An exception is meadow lands that have been compacted to the point that vegetation will not grow and storm runoff and snowmelt is concentrated enough to accelerate erosion. If roads are removed, the compaction of the road surface should be mitigated. Vehicular traffic in meadows should be discouraged. It is recommended that wood cutting permits and hunting licenses contain statements to that effect.

Results of firewood cutting in Haystack Draw meadow.

II. HYDROLOGY AND STREAM CHANNELS

Step 1: What are the dominant hydrologic characteristics and other notable hydrologic features and processes in the watershed?

The Winema GIS data base includes nine complete subwatersheds within the study area (1801020101B Long Prairie, 1801020101C Jackson Cr., 1801020101D Deep Cr., 1801020101E Sand Cr., 1801020101F Williamson River Headwaters, 1801020101G Wildhorse Cr., 1801020101H Bull Pasture, 1801020101I Haystack Cr., 1801020101Z Williamson River) and a small portion of one other (1801020102Z Williamson River in vicinity of Klamath Marsh).

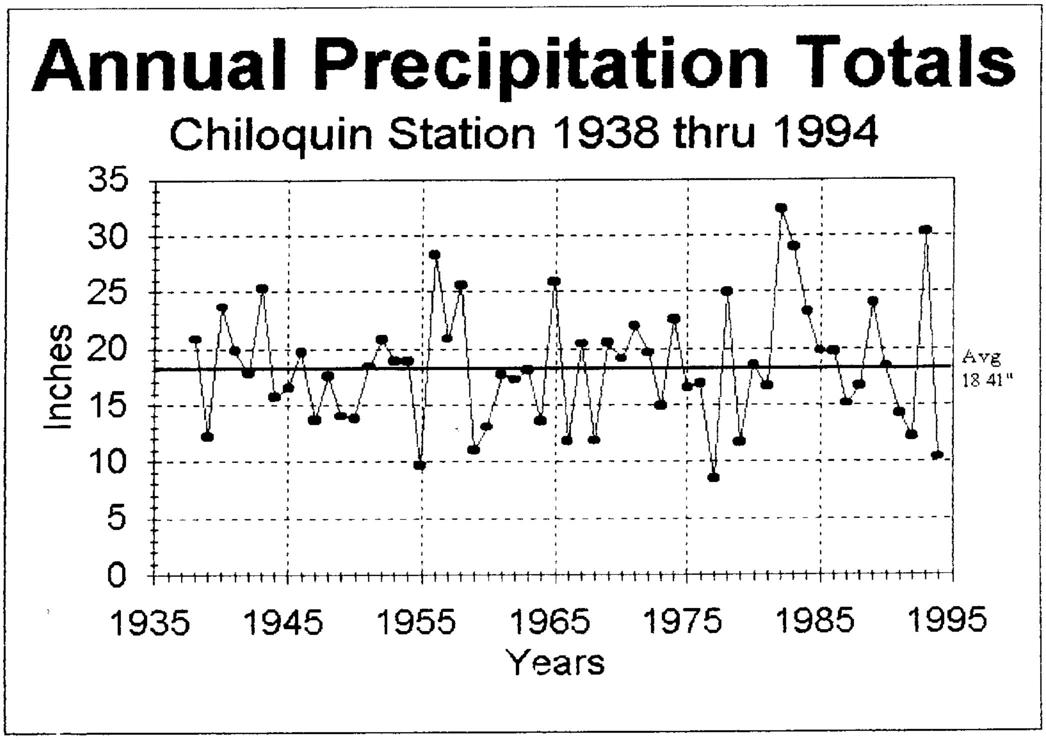
The data base also shows 414.5 miles of stream in the study area, for a stream density of 1.3 miles per square mile of land area. This reflects a range of stream densities from a high of 2.3 miles per square mile for Jackson Creek, to a low of 0.5 miles per square mile for Wildhorse Creek. In general, stream systems east of the Williamson River draining the high country have densities greater than the average, and those on the west have densities below the average. The higher densities east of the Williamson River reflect the higher precipitation associated with Yamsay Mountain and Booth Ridge and the steeper topography. Here, snowmelt and storm runoff moves through the soil profile to the stream systems and down to the Williamson River Valley. The low stream densities west of the Williamson River indicate the snowmelt and storm runoff moves primarily through the soil profile and groundwater table to the valley bottom.

Stream types east of the river classify primarily as "A" and "B" types. The most common classification is estimated to be B3. These streams have a low sensitivity to disturbance, excellent natural recovery from disturbances, low sediment supply, low streambank erosion potential, and moderate controlling influence from streambank vegetation. West of the river, stream channels are discontinuous in nature. Where they exist, they are predominantly "E" or "G" types. The most common classifications are estimated to be E5 or E6, and G5 or G6. These channels have very high to extreme sensitivity to disturbance, good (E) or very poor (G) recovery potential, moderate to high sediment supply potential, very high to moderate streambank erosion potential, and high to very high controlling influence from streambank vegetation (See appendix B, Rosgen Stream Types).

The Chiloquin Weather Station, located 20 miles southwest of the study area, is the closest long term station available to indicate annual precipitation amounts. Although the station is 400 feet or more lower in elevation, the precipitation amounts are expected to indicate general trends and variations in the study area weather.

Precipitation generally comes in the form of snow in the months of November through March, with the snow melt season being February through June. The Chiloquin Station data shows an average annual precipitation of 18.4 inches over the last 57 years. The important factor displayed in the data is not the amount of precipitation, but the variability from year to year. It is not uncommon for precipitation to vary by 10 to 20 inches from one year to the next, or for it to be significantly above or below the average for four to six consecutive years.

The boom or bust nature of the precipitation is reflected in the variability in total steam discharge amounts, peak flow timing, and minimum flow volumes. In general, peak flows occur during spring snowmelt, but may vary in time by a month or more. Maximum monthly flow volumes will also vary as much as 300% between drought and wet cycles. Minimum flows will also vary significantly, with streams on the margin between perennial and intermittent or intermittent and ephemeral moving back and forth in classification with the weather cycles.



The base flows in the Williamson River are influenced by several large volume springs that tend to mediate the effect of drought cycles The upland portions of the upper Williamson area serve as recharge sources for the groundwater aquifer and springs in the river valley.

Step 2: What are the current conditions and trends of the dominant hydrologic characteristics and features prevalent in the watershed?

The unstable channel segments in Telephone Draw, Haystack Draw, and the Bull Pasture appear to be improving after several years without livestock grazing and after placement of erosion control structures in the more critical areas Continued use of the meadows in these areas as vehicle access for firewood cutting place them at risk of additional channel degradation. The Williamson River between the Sand Creek reef and the Klamath Marsh has many actively eroding channel banks The current channel does not appear to be downcutting as much as moving laterally within its valley. The heavy sediment loads from the actively eroding banks is more than the channel can handle in some reaches, making the channel wide and shallow. A slow recovery process has begun in segments where annual grazing use has ceased. Unstable conditions persist in segments where annual disturbance continues. (See Appendix C for further information on channel conditions.)

1989 Watershed Improvement Project to correct headcut in Telephone Draw.

Step 3: What are the historical hydrologic characteristics and features?

Prior to the aggressive management of the timber and grazing resources, Haystack and Telephone draws and the Bull Pasture drainage systems were much as they are today in their overall hydrologic function They deliver water to the Williamson River Valley through subsurface flow. Outside of spring runoff, surface flow was limited to short canyon sections between flat meadow segments During above normal precipitation cycles, surface water may have covered most meadows at times of peak snowmelt. The meadows were largely devoid of a stream channel, with the highest velocity waters following the lowest path through the meadow This would normally be either at the center or at the margins of the meadow.

The Williamson River, before significant disturbance, was narrower and deeper, with well vegetated banks. Willows were a common riparian plant and bank erosion rates were a small fraction of the current rates. The flood waters likely had access to the broad valley bottom to dissipate energy over most of the river extent. Beaver dams may have been present in some upper reaches, aiding in the flooding of adjacent valley segments.

Groundwater recharge is not likely to have been any different than the current condition and the flows from major springs were likely similar to those of today.

Step 4: What are the natural and human causes of change between historical and current hydrologic conditions? What are the influences and relationships between hydrologic processes and other ecosystem processes?

Increases in total vegetative cover due to suppression of wildfires may have some small effect on total water yields in the study area, but vegetation is only one factor in the determination of water yield The major factor in every case is the amount, type, and timing of precipitation Other factors include slope angle, land form, geology, soil characteristics, stream channel density and gradient, depth to water table, watershed aspect, average air temperatures, and local differences between total potential and actual evapotranspiration. Current research indicates that the removal of 30% to 50% of the vegetation in a drainage may have a small (10% to 15%) increase on the total water yield.

A water balance analysis (S. Mattenberger 1995) for the Chiloquin area, developed from precipitation and temperature data collected between 1942 and 1971, indicates a total moisture deficit of approximately 4 inches. This deficit indicates the difference between the soil moisture available to plants during the growing season and the amount of water the plants would use if supply was not limited. The months of April through October all show a moisture deficit. That is, the input to the soil moisture pool is less than the plants could use. Any gains in water yield from removal of vegetation will tend to reduce the period of moisture deficit. This may make some additional groundwater available for release to streams in the months of April and/or October. Stream flows in the summer months are not likely to change. Intermittent streams would not be changed to perennial, nor will the base flow in perennial streams be increased.

Grazing effects on the stream channels of the study area are generally limited to the Williamson River Valley and the meadow systems west of the river. The effects include soil compaction, exposure of bare soil to erosion processes, and destabilization of stream banks by removal of deep rooted vegetation and by physically breaking down bank structure. These effects tend to contribute to accelerated erosion rates and channel downcutting.

Erosion gully created by cattle trail in the Bull Pasture system.

Grazing is not the sole factor in modifying channel conditions. Heavy grazing activities along with extended drought conditions make the meadow environments and the natural channels of the study area more susceptible to above normal or high intensity runoff events. Heavy runoff events along with sparse vegetative cover and weakened root mass accelerate erosion rates and destabilize the channels. This condition is then aggravated by continued grazing pressure.

The major example in the study area is the Williamson River. Below the confluence with Sand Creek, the river banks are generally devoid of the natural stabilizing vegetation (Willow), the channel is relatively wide and shallow, and the channel banks are aggressively eroding every year during high flows. Flood flows no longer have access to the valley floor to dissipate energy and control erosion rates. Continued use of the river banks by domestic livestock tends to maintain this unstable condition, adding to the already abnormally high sediment loads. The initial cause of channel destabilization was likely the downcutting of the main channel, when the water level of the Klamath Marsh lowered near the turn of the century. Continuous grazing use has retarded the recovery of the channel form to a more stable condition.

Long term effects of past cattle grazing on the current Yamsi Allotment near Sand Creek Ranch.

The portion of the river directly above Sand Creek appears to be controlled by a natural reef. In spite of heavy manipulation of the natural channel by grazing, dams, and diversion, much of this section of the river maintains a contact with its natural flood plane and appears have less channel bank erosion.

Haystack Draw, Telephone Draw, and Bull Pasture drainage systems west of the Williamson River all have segments of downcut channels that appear to have been caused by a combination of heavy grazing use, vehicle traffic in the meadows, drought, and heavy runoff or high intensity storm events. The lack of grazing use in the last several years has allowed each of these channel segments to begin the healing process. Most of the perennial and long term intermittent stream systems east of the Williamson River have been captured for use as a source of water for pasture irrigation. This has been the case since the early 1900's. The result of these diversions has been to eliminate or dramatically curtail the surface water connection between these tributary streams and the river. This break eliminates the point source effect of infusion of high quality, cool water into the river during the summer months. The benefits of such an infusion would be noticeable at the confluence of the tributary and the river, and for a short distance downstream. Although diverted, some portion of the tributary flow currently finds its way to the river as groundwater released from the valley sediments

Jackson Creek, Irving Creek, Aspen Creek, and Deep Creek are the most obvious examples of the diversion of once tributary streams. Jackson and Irving Creeks have lost all surface connection to the river, except during the highest runoff conditions. The connecting channels have been heavily modified by agricultural use. Deep Creek has much of its flow diverted into the Aspen Creek drainage during the spring and summer months. Deep Creek does maintain a surface flow connection to the river during early spring high flows (before the diversions are activated), and likely during above normal precipitation cycles.

The high sediment yields and changing channel form from the destabilized channel banks in the Williamson River have affected the quality of the aquatic habitat. Increases in water temperature and decreases in hiding cover for resident fish are the most obvious effects.

Recommendations

Keep these guys....

....out of here!

III. VEGETATION

Step 1: What is the array and landscape pattern of plant communities and seral stages in the watershed (riparian and non-riparian)? What processes caused these patterns (e.g. fire, wind, mass wasting)?

Approximately 10% of the study area is classified as grasslands, with another 1% as rockland or sparsely vegetated. Four percent (4%) is shrub covered lands and the remainder (85%) is forested. Of the forested lands, over 2/3 is in the 26% to 100% crown closure class. The general vegetative condition of the watershed is consistent with the overall health of the hydrologic system. Long term agricultural use of the grasslands along the Williamson River and its tributaries has resulted in localized destabilization of stream banks and increased sediment loads. Past commercial forestry activities have removed forest and riparian vegetation from the near-stream area, and in some cases may have reduced the period in which intermittent and ephemeral systems flow water. These effects are generally localized and have not impaired the basic function of the hydrologic system. There is now more "forest" vegetation in riparian areas than ever before, as a result of fire suppression, cattle grazing, etc. The majority of the FS riparian areas have had very little harvesting, the opposite is true of private ground.

The Winema's GIS data base shows 9% of the study area, excluding the Weyerhaeuser holdings, as riparian vegetation communities. Of this, nearly 2/3 is grass or brush lands. The majority of these grasslands are located in the Williamson River Valley. The remainder of the mapped riparian lands are forested with a variety of tree species.

A review of the Winema GIS data base for lands immediately adjacent to the study area streams (including the Weyerhaeuser holdings) shows that 31% of the stream miles flow through grass and brush lands. This leaves 69% of the near-stream vegetation as forest types. The majority of the forest types have a crown closure of 25% to 50 %. This forested condition offers adequate stream shade and a source for large woody debris.

To set the stage for all portions of the discussion steps, the classical terms used to describe seral/climax stages become misleading when discussing the types in this area and referencing the historic type. For example; often a stand/type has some components in an early seral stage, and some in a late seral/climax stage (such as a recently underburned stand of old growth ponderosa pine). An attempt will be made to refer to structure, disturbance/lack of disturbance and components affected, rather than simply a seral stage.

The PMR data examples shown for all species types are pixel data and not stand delineations. This is to more graphically display the range of the species, rather than a "type". Rules for typing are capricious and variable, and lead to confusion when discussing past, current, and future conditions and changes. Currently, multiple species appear on most acres, which is precisely the point of this type of display. Accuracy of the PMR data is not perfect, but adequate to show distribution and crown closure at this scale. Riparian types are the exception since they are controlled by topography and water table, and are therefore limited to physical locations.

DISTRIBUTION OF TYPES

The Riparian Areas map on the next page shows the riparian acres on the Winema NF These areas represent the current distribution of the moist and wet riparian types Descriptions of these types are listed below.

Mesoriparian - Riparian Meadow Type

These areas include "wet" lodgepole/widefruit sedge community types. Many of the acres in this type may currently appear as the next drier group of types, such as lodgepole pine/forb etc. (CL-M2-11, or possibly CL-M3-11).

Landscape Pattern

This is the wettest terrestrial vegetation type. Location is determined by topographically controlled water tables most often found as narrow stringers proximal to perennial and intermittent drainages, and in perched water tables found in circular depressions.

Seral Stages

Grass forb phase - This phase might best be typed as early-mid seral, with forbs being the early and grasses the mid seral stages. Grasses and forbs are the predominant vegetation, with Kentucky bluegrass and wild rye predominant. In some areas the grass/sedge phase may be mid-late seral. Willow and/or aspen may be present to a limited extent in the mid-late phase, or entirely absent.

Conifer phase - The conifer structure dominates the stands, and is mature 60-80+ year old lodgepole at very high densities and varying sizes, generally from 4-16" DBH. Understory conditions evolved as a result of little disturbance. Some older conifer mortality patches (approximately 1/10 ac. in size), have regenerated with very high seedling densities. Absence of disturbance has allowed this type to evolve to a lodgepole dominated type. Current insect mortality appears to be reducing the lodgepole component.

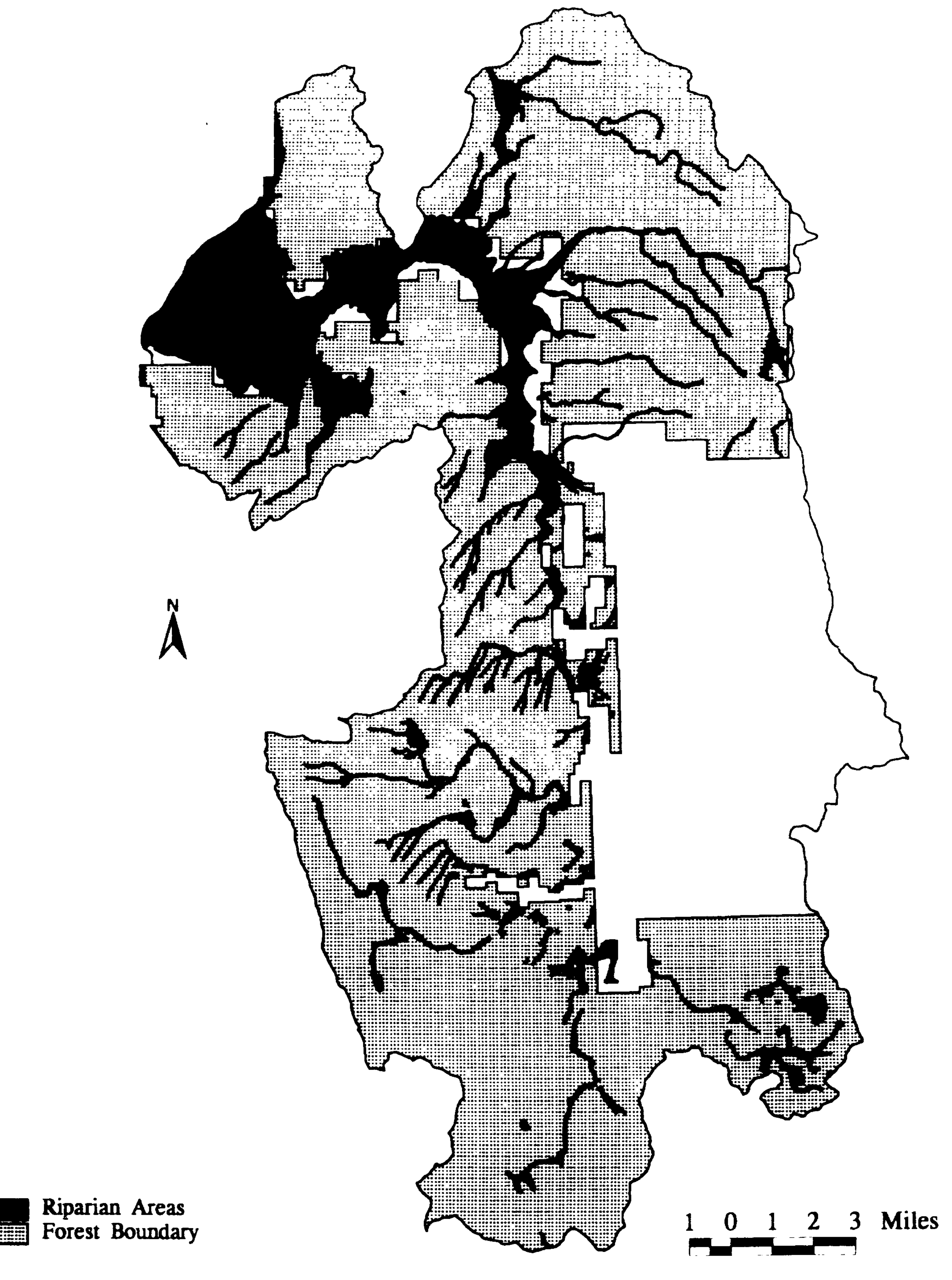
Xeroriparian - Riparian Lodgepole/Upland Meadow Type

This includes the "moist" lodgepole type (CL-M2(3)-11), and is potential vegetation for the wetter "shrub" lodgepole types closely associated with riparian areas. For example, any lodgepole type with a perched water table and/or brief periods of standing water, where soil is basically well drained (such as CL-S2-13 lodgepole/putr/forb).

Landscape Pattern

This type is associated with riparian areas, which are in most cases, long, relatively narrow stringers feeding into the Williamson River. There is generally not connectivity within this type, except along the river.

Riparian Areas



Moist terrestrial vegetation type, location is determined by topographically controlled water tables, found as narrow stringers on slightly higher ground than Mesoriparian type and in perched water tables found in circular depressions

Seral Stages

Most of these acres are dominated with mature lodgepole pine, the grass/forb component being absent or very mature/decadent.

Lodgepole pine type

Landscape pattern

The PMR Lodgepole map on the next page shows the distribution of lodgepole pine in 1988. Only minor changes have occurred since then.

The non-riparian lodgepole sites are generally found in basins and cold air drainages. These stands are nearly pure lodgepole pine, but occasionally ponderosa pine trees are present.

Seral Stages

Approximately 80%+ of the acres are in mature lodgepole, with the overstory in a late seral condition. An early seral seedling/sapling component has developed in areas of mortality and other localized disturbances. Grass/forb and shrub components are generally limited due to the extremely high stocking of lodgepole. The exception is bitterbrush, where present. Bitterbrush in most areas is 40+ years old and has reestablished since the initial BIA logging.

Ponderosa pine type

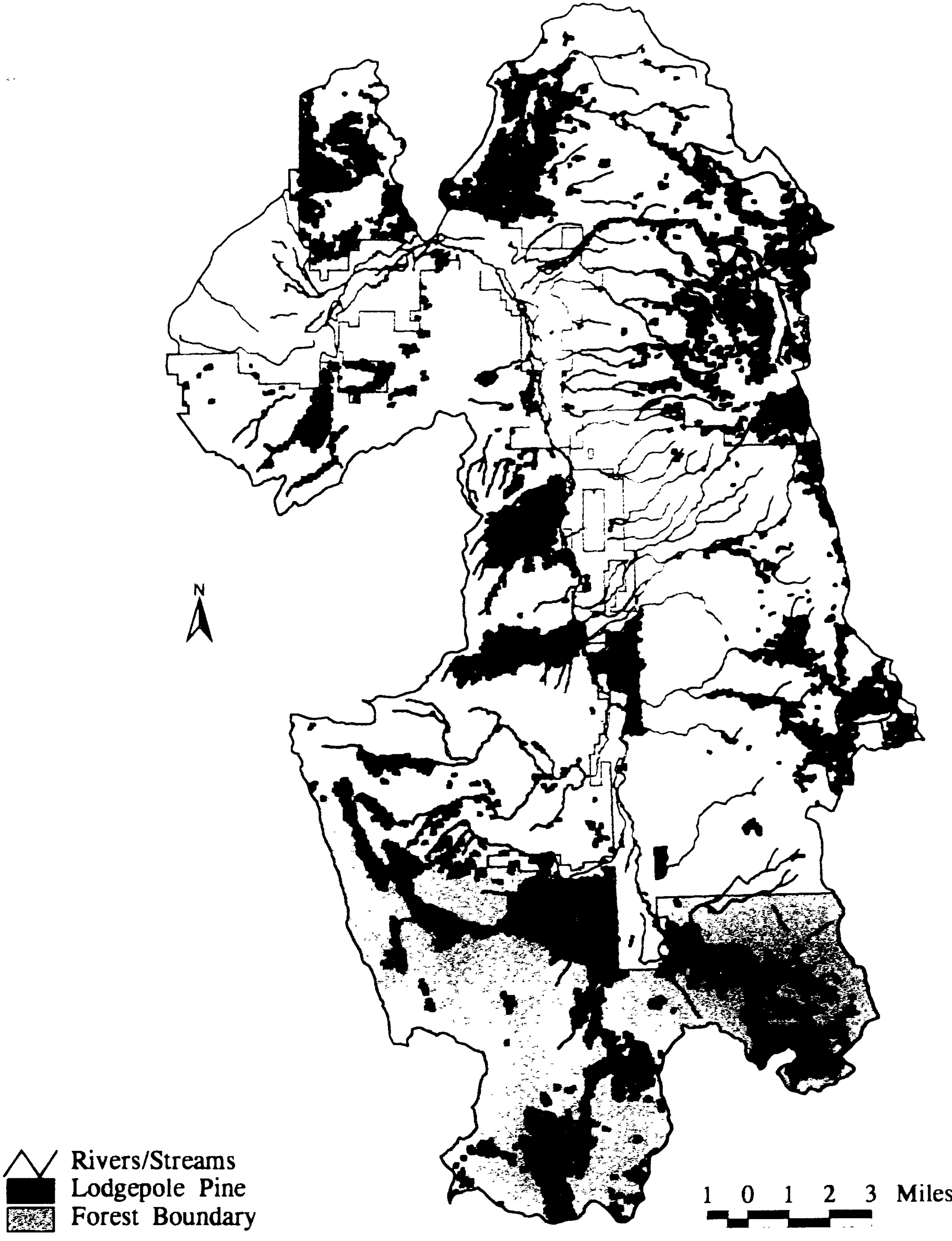
Landscape pattern

The PMR ponderosa pine map shows the 1988 distribution of ponderosa pine. Generally it is located upslope from basins or on ridges. The current ponderosa pine type generally transitions into a mixed conifer type between 5500 and 6000 feet. This type may include lesser amounts of lodgepole pine, Douglas fir, white fir and sugar pine.

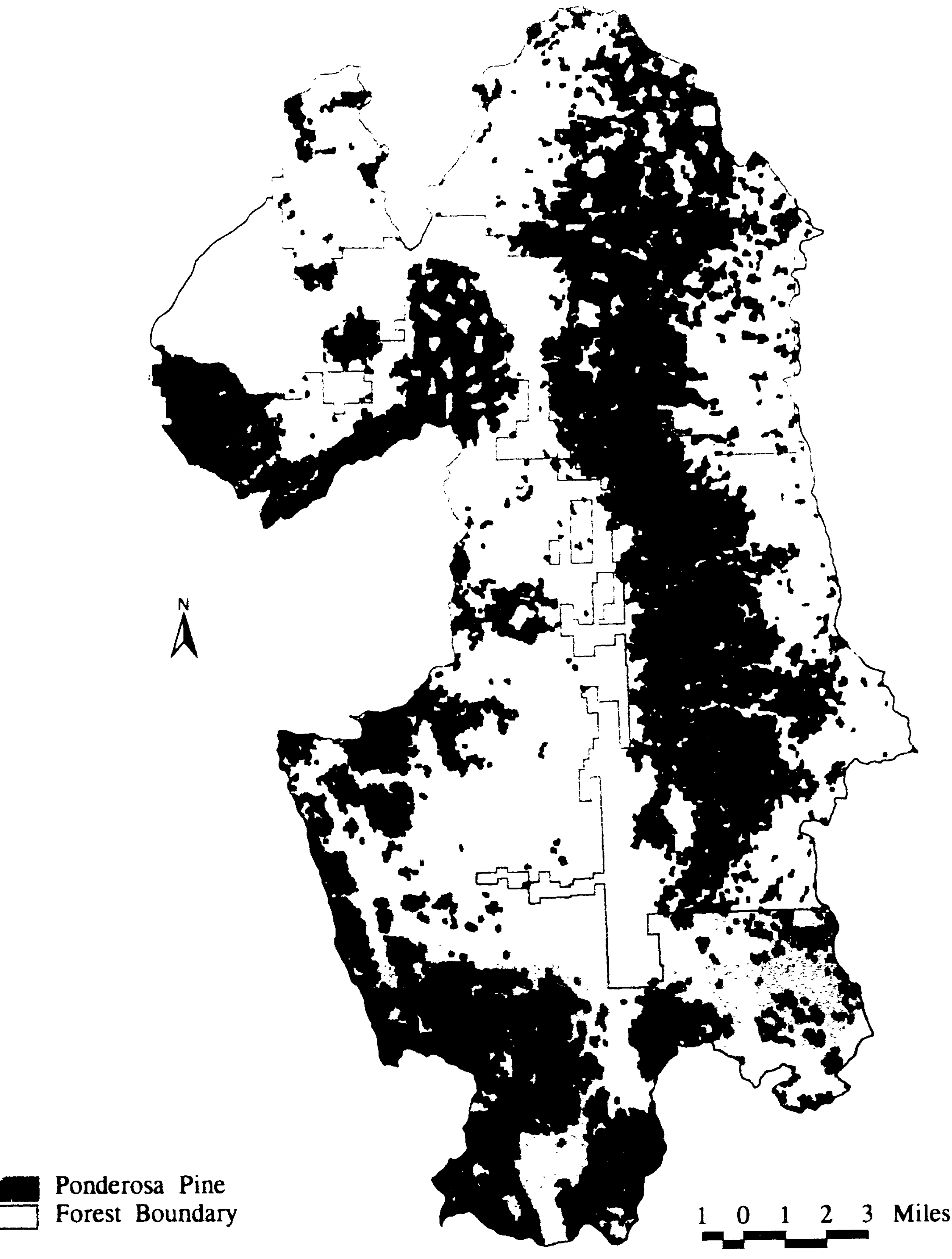
Seral Stages

Most of the ponderosa pine type includes an overstory component, except in areas of total overstory removal (see later section on harvest activities). The overstory consists of "mature" trees which have attained most of their height growth and potential crown development. These trees are in a late seral condition Nearly all of these stands contain a heavily stocked understory with trees established since fire suppression activities began, or the last major ground disturbing activity For most of the area the last major ground disturbing activity was the BIA logging. These trees may be in either an early or

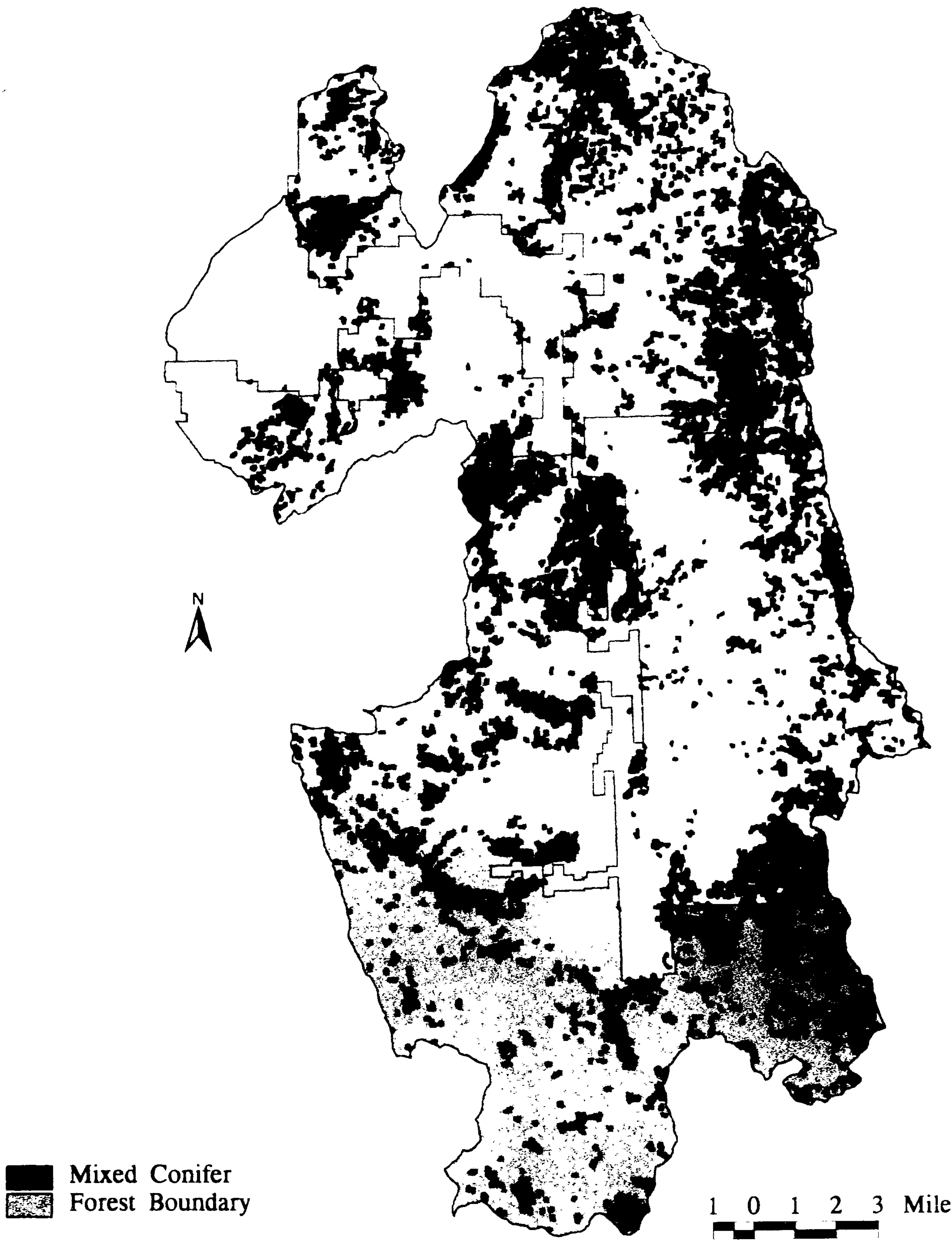
Lodgepole Pine Distribution



Ponderosa Pine Distribution



Mixed Conifer Distribution



mid seral stage. The shrub component is mostly bitterbrush established since the BIA harvest, and is in a late seral stage. The grass/forb component is often limited due to intense conifer and brush competition. When the grass/forb component is present, it is usually early seral.

White Fir/Mixed Conifer Type

Landscape Pattern

The PMR white fir map on the next page shows that white fir is present throughout most of the area, except for the basin areas. White fir component of the stands generally increases with elevation/moisture increases, except at the highest elevations.

Seral Stages

The very presence of white fir usually indicates that the area is in a late seral stage. However, most of the white fir is relatively young (100 years or less), although they may be larger than adjacent ponderosa pines which may be 2-4 times older. The extensive wildfires of 1918 (200,000+ acres burned), followed by the very wet climate of 1919, provided optimum conditions for establishment and early growth of all conifer species. This led to a dramatic increase in successful White fir establishment and growth. The first fire suppression efforts started in 1908, but were not very successful until after WWI (ca. 1919). The failure to stop the 1918 wildfires appears to have given this work increased priority. The larger effective fire suppression forces on the reservation successfully limited acres burned for many years. This resulted in lack of mortality to the newly established understory.

High Elevation Type

The high elevation type begins around 6200 feet in elevation. The current condition is dependent upon the amount of time since the last stand replacing fire. Immediately after fire, lodgepole pine along with herbaceous vegetation colonizes the site. Slowly, white fir, mountain hemlock, white pine and Shasta red fir become established.

Landscape Pattern

This type is in one large block, located exclusively on the upper slopes of Yamsay Mountain.

Seral Stages

The lodgepole type reflects an early seral stage (see PMR Lodgepole map for locations). Non-lodgepole areas are late seral.

Step 2: What are the current conditions and trends of the prevalent plant communities and seral stages in the watershed?

Type	Current Condition	Trend
Meso-Riparian	**Grass phase** - Dominated by grasses that are stimulated by grazing, some areas still retain willow component. aspen nearly absent Kentucky bluegrass, tufted hairgrass, and/or Nebraska sedge are present. **Conifer phase** - Until recently was dominated by lodgepole with minor surface vegetation, sedges, bearberry, spirea	**Grass** - No change **Conifer** - Lodgepole is rapidly dying Opportunity for expansion of existing willow and aspen and forb shrub component exists Multiple factors will shape future vegetation mix, could also return to lodgepole
Xero-riparian	Majority in mature lodgepole, mortality is occurring at slower rate than Meso sites Minimal grass/forb component due to recent heavy lodgepole stocking Natural lodgepole regen occurring at thousands of TPA	Patchy, continuous lodgepole mortality Generally lodgepole will replace lodgepole
Lodgepole	75%+ in mature lodgepole, with minor, but continuing patchy mortality occurring Some lodgepole regen establishment, at hundred or less TPA More often, existing mature lodgepole are utilizing the growing space vacated by mortality Approximately 25% of the type has been harvested Regeneration harvesting has occurred in 10 % of the type, resulting in plantations of planted ponderosa and lodgepole pine Ponderosa pine not rapidly growing above frost Lodgepole growing well Precommercial thinning planned or accomplished in most plantations 10+ years old	Cumulative effect of mortality will result in a very slow stand replacement, with high fuel loading, resulting in high fire susceptibility and damage to seedlings Opportunity for grass reestablishment Timber harvesting may do basal area reductions on more acres to achieve short term retention of some of these stands Will also allow some lodgepole and grass regeneration
Ponderosa pine	Most acres are in a highly overstocked, multi storied condition Notable exceptions to this are the Bluejay, County Line and Site Prep 80 regen units Except for the regen units, minor mortality is occurring in the larger size classes Less white fir increase than seen in other watersheds, but white fir is increasing Mistletoe is heavy in most stands Surface vegetation is mostly limited to older, woody Bitterbrush, and a very limited grass/forb component Often a thick ponderosa pine needle mat is present, which would prevent successful germination even if growing space were available for other vegetation All of the type was harvested by the BIA prior to 1960 Approximately 50% of the type has been reentered by the FS since 1960 Many of these acres were large salvage sales with very light removals	Cumulative effect of mortality is resulting in reduction of large tree component and increase in fuel loading resulting in high susceptibility for large stand replacement fires Conifer growth is far exceeding mortality at this time, however, stress related mortality is increasing and will result in a nearly stand replacing mortality event until the stand burns Expect Ips pini to begin to cause increased mortality in the 2-8" stand component due to dense stocking in that size class and increased emphasis in retention of down woody debris, which provide excellent overwintering habitat for this insect These types are poorly able to naturally return to their previous condition after a large stand replacement event Natural recovery after a stand replacement fire is highly dependent on several variables, mostly related to size/shape of fire and timing and condition of that year's cone crop

White Fir	Mortality is occurring in these stands, but generally at a lesser rate than in other adjacent watersheds The Fuego Mountain area is currently an exception In all areas large ponderosa and sugar pines are suffering high rates of mortality Generally the fir is at high risk, but mortality rate is low Surface vegetation is nearly absent All of the type was harvested by the BIA prior to 1960. Approximately 30% of the type has been reentered by the FS since 1960 any of these acres were large salvage sales with very light removals.	While these stands are at high risk for stress related mortality, they are at higher risk for stand replacement fire Therefor, discussion of insect and disease risk is probably immaterial in the long term Most of the past timber harvests in this type were not heavy enough to reduce the risk of fire or stress related mortality These types are also poorly able to naturally return to their previous condition after a large stand replacement event Natural recovery after a stand replacement fire is highly dependent on several variables, mostly related to size/shape of fire and timing and condition of cone crop that year
High Elevation	Stands are at high risk for stand replacement fire. Insect and disease mortality is generally minimal or non-existent at these elevations. Stand replacement events are the norm for this system and should not result in irreparable damage to the vegetation	Stand replacement fire will occur in the foreseeable future. After a non-conifer phase, these stands can naturally return to their current condition This process may take 200+ years, which is normal for this type Fire size may result in a total loss of wildlife habitats currently present in the area.

The table above provides a synopsis of the current conditions and trends of the prevalent plant communities discussed in Step 1.

Step 3: What is the historical array and landscape pattern of plant communities and seral stages in the watershed?

Mesoriparian

These areas were typically a mix of hardwoods/grass/forbs, with a large willow and aspen component. Stream banks were edged with tall willow. Aspen was found more at transition zones with the xeroriparian type. Where this type occurred in wide basins, willow patches of several acres or more were present. Interspersed were lush grassy meadow areas with blue wild rye and tufted hairgrass and inflated/beak sedges dominating.

Higher water tables and beaver dams created aquatic vegetation habitats within these types, which are totally absent now.

Mesoriparian areas were fairly stable over time, with little variation due to fire. Occasional low intensity fires would rejuvenate small areas, especially edges. Most of the time fuel moisture would be too high for this type to burn, until a large amount of dead woody material had developed. Fire entered these areas through burning snags that had fallen but were not embedded in the soil. As fire burned the downed snag, heat was conducted to vegetation immediately adjacent to the snag. This created a mosaic of uneven aged burned "fingers" or islands within the type.

Xeroriparian

This type is unique compared to other watersheds on which analyses have been conducted

These areas were typically dominated by lodgepole pine, not necessarily as pure stands, but with lodgepole as the dominant species. This condition has not been identified outside of this watershed. It is based on BIA cruise data, and was present on a significant amount of acreage. It is most likely that the type moved between an aspen/willow/lodgepole mix and slowly became mostly lodgepole. This condition would persist until a fire, probably in a mosaic pattern, moved the area back to aspen/willow with lodgepole recolonizing the area. The natural fire regime for this area was quite variable, ranging from frequent, low intensity mosaic burns to infrequent, high intensity stand replacement burns. Consequently, there was probably high variability in this type over time and space.

Lodgepole pine

Historically these sites were more of a shrub-steppe than conifer type, although clumps of lodgepole and individual lodgepole would have been present. Bitterbrush is not frost tolerant so would rarely be found on these sites.

This type was probably also highly variable over time and space. This would account for inconsistent anecdotal references and most conspicuously, lack of reference to lodgepole growing on the drier types. The current relatively poor rate of natural regeneration of lodgepole (compared to the wetter types) also supports the likelihood of these sites being mostly in a moist/dry meadow condition with scattered areas of lodgepole. Occasional individual ponderosa pine may have been present.

Ponderosa pine

Stands with less than 50% fir were generally in an open, park-like condition, dominated by a continuous large-tree structure with occasional clumps of reproduction (up to 5 acres). Trees were often growing in clumps of 2 or 3, with 50-100 foot openings between the small groups of trees. Ponderosa pine roots can occupy a large area, often reaching out 100 feet or more, so it is likely that reportedly open areas may well have been 100% occupied by large tree root systems. Proportionately less growing space was occupied by conifers, with grasses, sedges, and brush covering a larger percentage of area within the stands during the reference period.

Information regarding understory stocking in the reference period ponderosa stands is very limited. Plot data from 1936 and 1948 (BIA Archive Files) for the South Calimus and Wildhorse Ridge areas, shows a range of 9.5 to 17 trees/acre larger than 12" DBH. This data is considered representative of pine sites within the analysis area. Anecdotal notes and inventory entries during this period often comment on a lack of understory vegetation. The Long Prairie cut-over cruise recorded 2.8 small poles (4-7") and 3.4 large poles (8-12") per acre, and noted these were in clumps.

Data from the 1899-1920 period is considered sufficient for determining the reference period conditions, since most of the local forests were relatively untouched at that time. The seedling component may have changed, but it is doubtful. References scarcely mention older seedlings, but do address the open characteristics of most stands. Our knowledge about fire frequency and intensity supports the premise that the understory component was excised by periodic fire on a regular basis during the reference period.

Cochran has demonstrated that ponderosa pine growth rates have increased since the advent of fire suppression, but the reasons are still unknown. The increased growth may be due to less competing non-conifer vegetation (increased surface litter may be causing a reduction in the availability of germination/growing sites), or a soil productivity increase due to increased moisture holding capacity or nutrient availability. Much more research is needed on this subject.

The pine type dominated most upland areas, with stand volumes ranging from 5-20+MBF/ac. (average 10MBF). High volume stands occurred in higher elevation and moisture regime areas, and contained more sugar pine, Douglas fir and white fir.

White fir

This type was absent in the historical condition. That is not to imply that there were no individual white fir trees present, but that white fir was not the dominant species on any significant acres.

High Elevation

This type was generally found above 6000-6500 feet elevation. For the Upper Williamson, it was restricted primarily to the upper slopes of Yamsey Mountain. This type was a different regime than all the other areas, and probably not substantially different than what is now present.

Stand replacement fire events, large or small, were natural occurrences. Periodicity could be highly variable, 2-500 years perhaps. The stand would regenerate with brush and/or lodgepole pine and follow a classical development to a climax white fir/hemlock/Shasta red fir stand.

Step 4: What are the natural and human causes of change between historical and current vegetative conditions? What are the influences and relationships between vegetation and seral patterns and other ecosystem processes in the watershed?

The major natural and human causes of change in vegetative conditions are:

1. Predation on conifers has decreased greatly since historic times. Natural responses to human activities (predominantly fire suppression), has resulted in:
   →Growth far exceeding mortality.
   →Wildfire being nearly eliminated as a cause of mortality
   →Insect and disease mortality being almost zero since the end of the last major bark beetle epidemic in the 1940's; until the last 5 years.

2. Uncontrolled growth has changed stand structure
   - The under and mid-story components have flourished
   - Large tree structure has actually remained fairly constant except for heavy overstory removal units and clearcut units.
   - Non-conifer vegetation has been out-competed by conifers; resulting in a dramatic reduction of hardwoods, non-bitterbrush brush, grasses and forbs.
   - There has been an increase of lodgepole on mesoriparian and historic grass types.
   - Ponderosa pine types have experienced an increase in stocking levels and an increase in fir presence within the types.

3. There has been a major change in stand function:
   → Stands respond more as a stand; rather than individual trees or small clumps of trees.
   → A high potential for stand replacement events exists, whether from fire, insects or disease.
   → Survival and reproduction strategies for ponderosa and lodgepole pine are not developed for this stand structure.

4. Changes from harvest activity:
   → Reference harvest chart below *Note: Accuracy of the harvest layer is variable. Often the sale area boundaries, rather than actual cut units are mapped. This leads to the appearance of more acres being harvested than actually are; and conversely, uncut areas within the sales may have higher densities than are indicated.*

   PMR data is pixel data, not stand data. Each stand will be a mixture of CC (Crown Closure) and grass shrub pixels, based on reflectance within the stand based on 20m (approx 0.1 ac area) pixels which were resampled at 90m for this analysis. For reference, historical stocking conifer stands should probably show approximately 50% grass shrub pixels, and generally not have Tree CC pixels over 41%.

The following graph shows the vegetation class of harvest areas by decades. This graph reflects both the varying eras of harvest treatments and the regrowth that has occurred. For example, note that 26% CC often represents a fully stocked stand; 41%+ represents a high risk for stress related mortality.

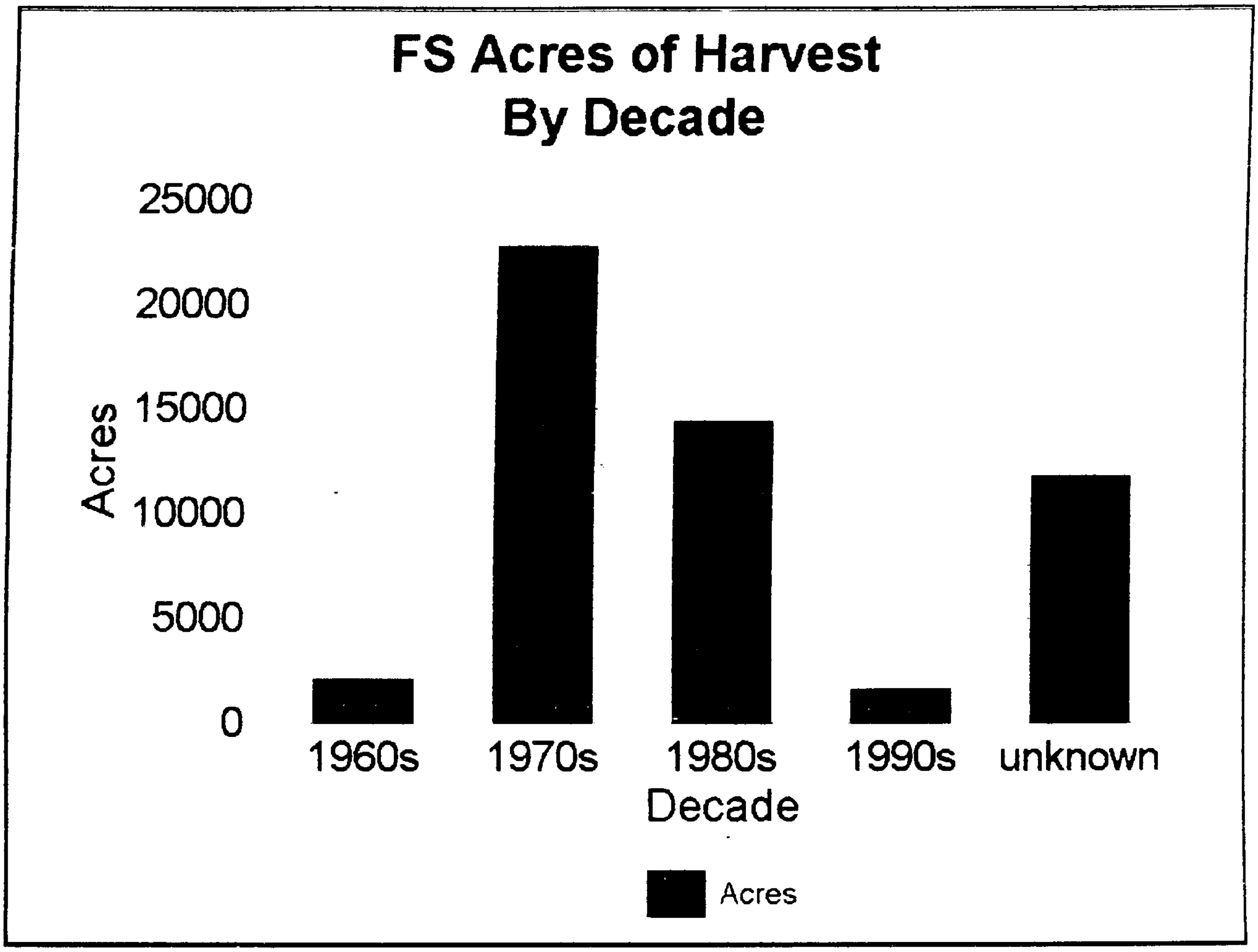
→ Harvests of the 60's tended to be high-risk/low vigor partial cuts with little stocking level control objectives. SPC may or may not have been accomplished. Note that 72% of the acres harvested in the 60's are at 26% CC or greater, and that 34% of the 1960's harvest is in inventoried OG.

→ The harvests of the 70's were still partial cuts; note that 92% of the acres harvested are currently 26%+ crown closure, and 30% are inventoried OG.

→ The harvests of the 80's reflect the clearcutting/seed tree/shelterwood era (also some heavy overstory removals that resulted in clearcuts). Not all harvests of this decade were that severe. 72% of the acres are 26%+ CC, and only 6% are inventoried OG. However, the average crown closure will be the lowest of any decade.

→ The harvests of the 90's were generally a lighter overstory removal that emphasized retention of the black-bark ponderosa pine. 85% of the acres are in 26%+CC, and 28% are inventoried OG.

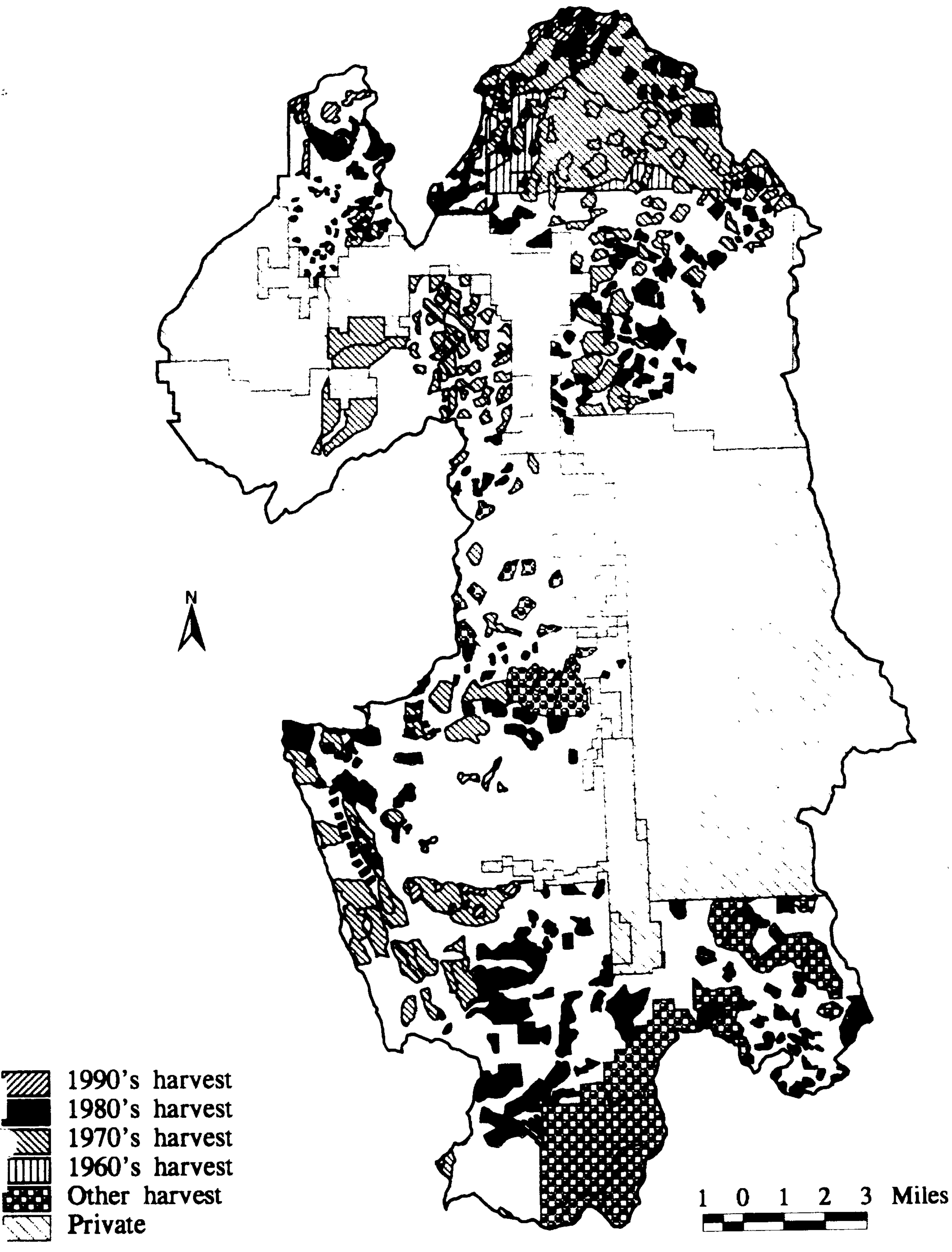
- Approximately 25% of the area is a lodgepole type and old growth has not been designated for lodgepole types. Approximately 75% of the lodgepole is currently in an "Old Growth" condition Those acres are not reflected anywhere in the charts or summaries



Comparing the *Inventoried Old Growth* and *Harvest Areas* maps on the following pages shows that in general, past harvests have not resulted in elimination of those areas from old growth classification.

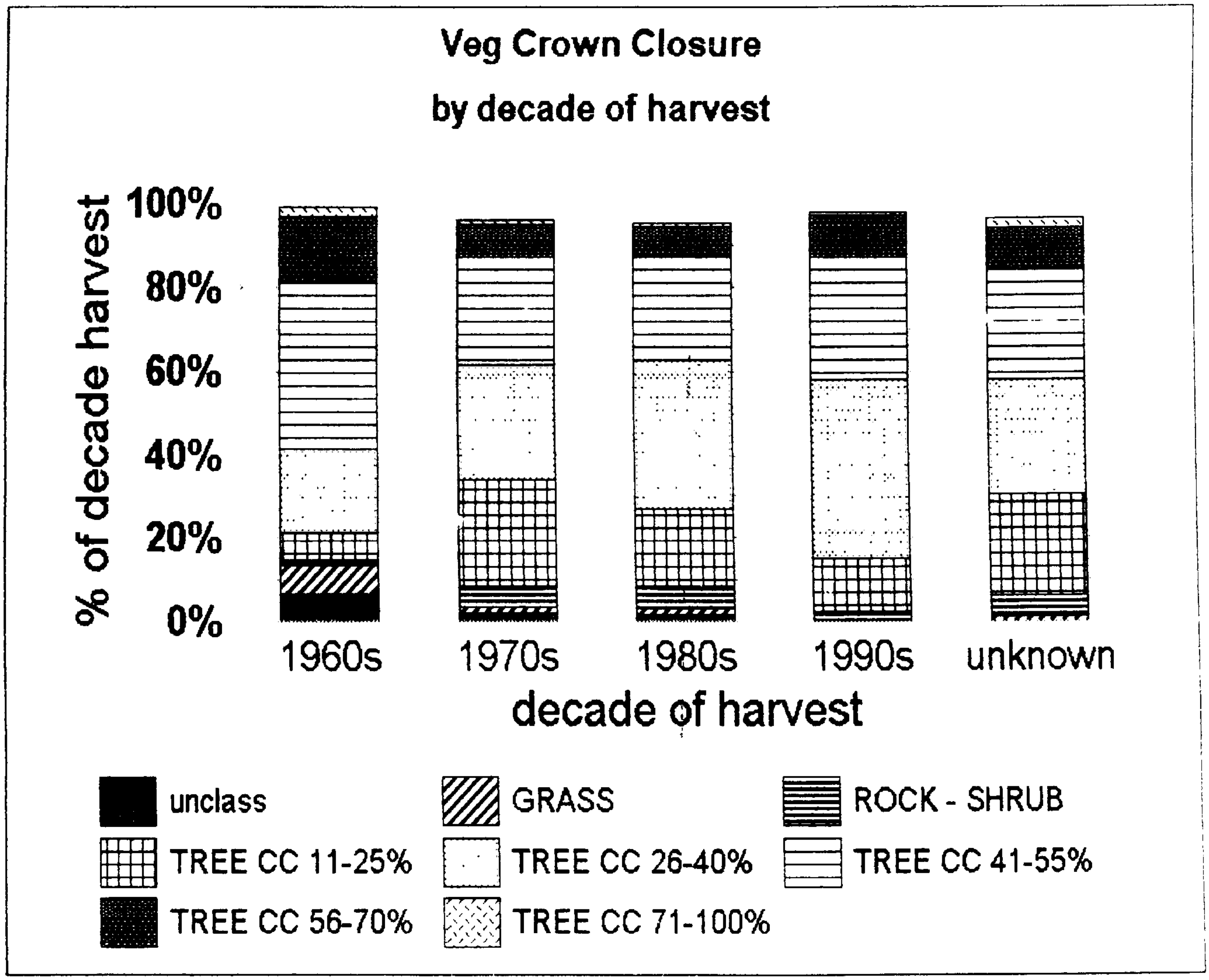
Inventoried Old Growth

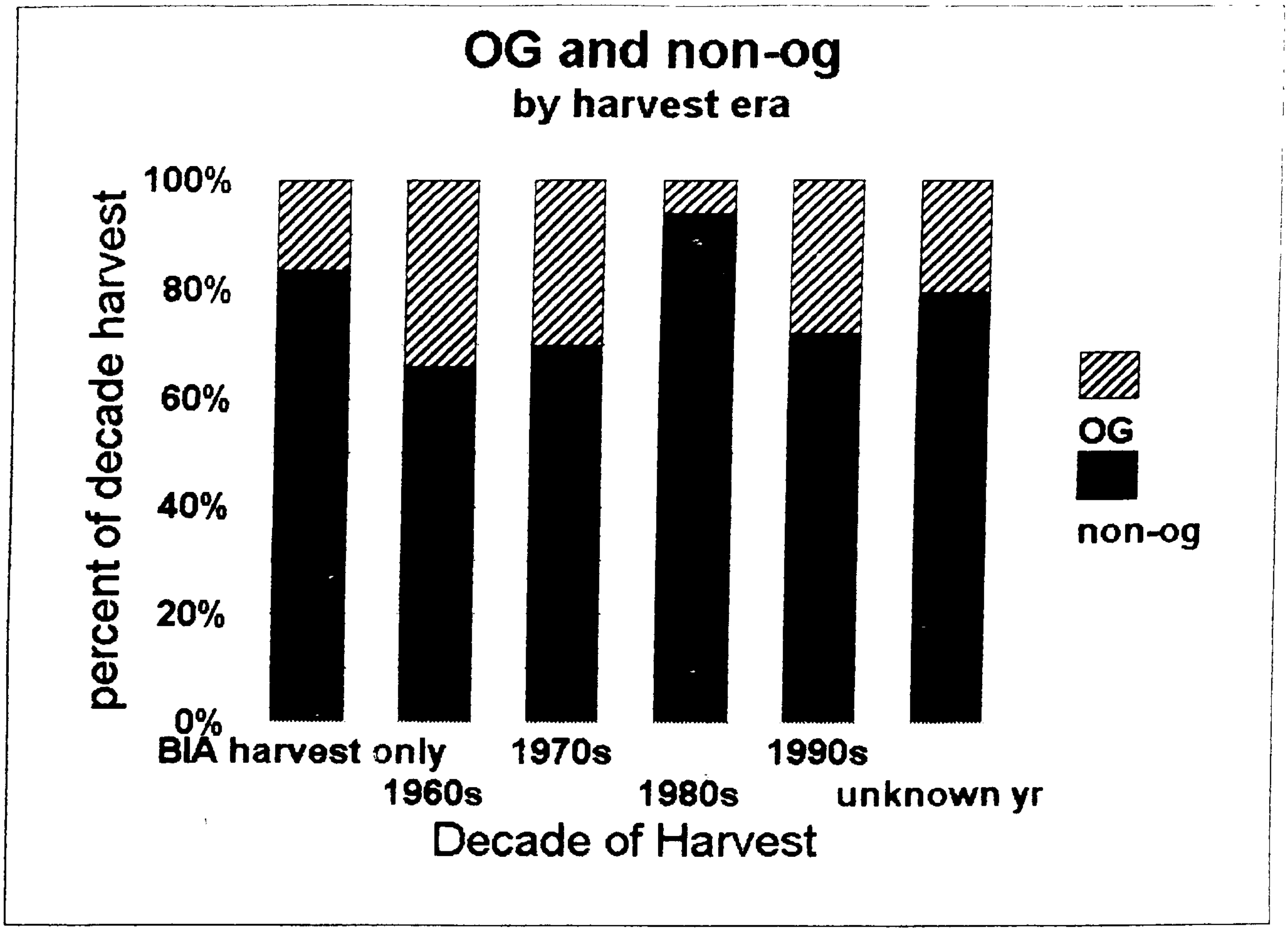
Harvest Areas by Decade



Comparing the Tree Crown Closure % from PMR depicted in the "Veg Crown Closure by decade of harvest" graph below indicates.

- That generally, the distribution in classes between areas harvested since FS management is not of significantly different structure or stocking than the area as a whole
- The 1980's harvest reflects the clearcut era, which does result in more grass/tree CC 11-25% than the rest of the groups.
- That over the entire watershed, harvest has not created a major change in conditions. However, on limited specific areas, it has.
- That approximately 50% + of the area is in pixels with 41% or greater tree CC. This represents stands not self-sustainable and at high risk for stand replacement events. The actual area at the stand level is probably much higher due to included pixels of lower stocking within those stands.





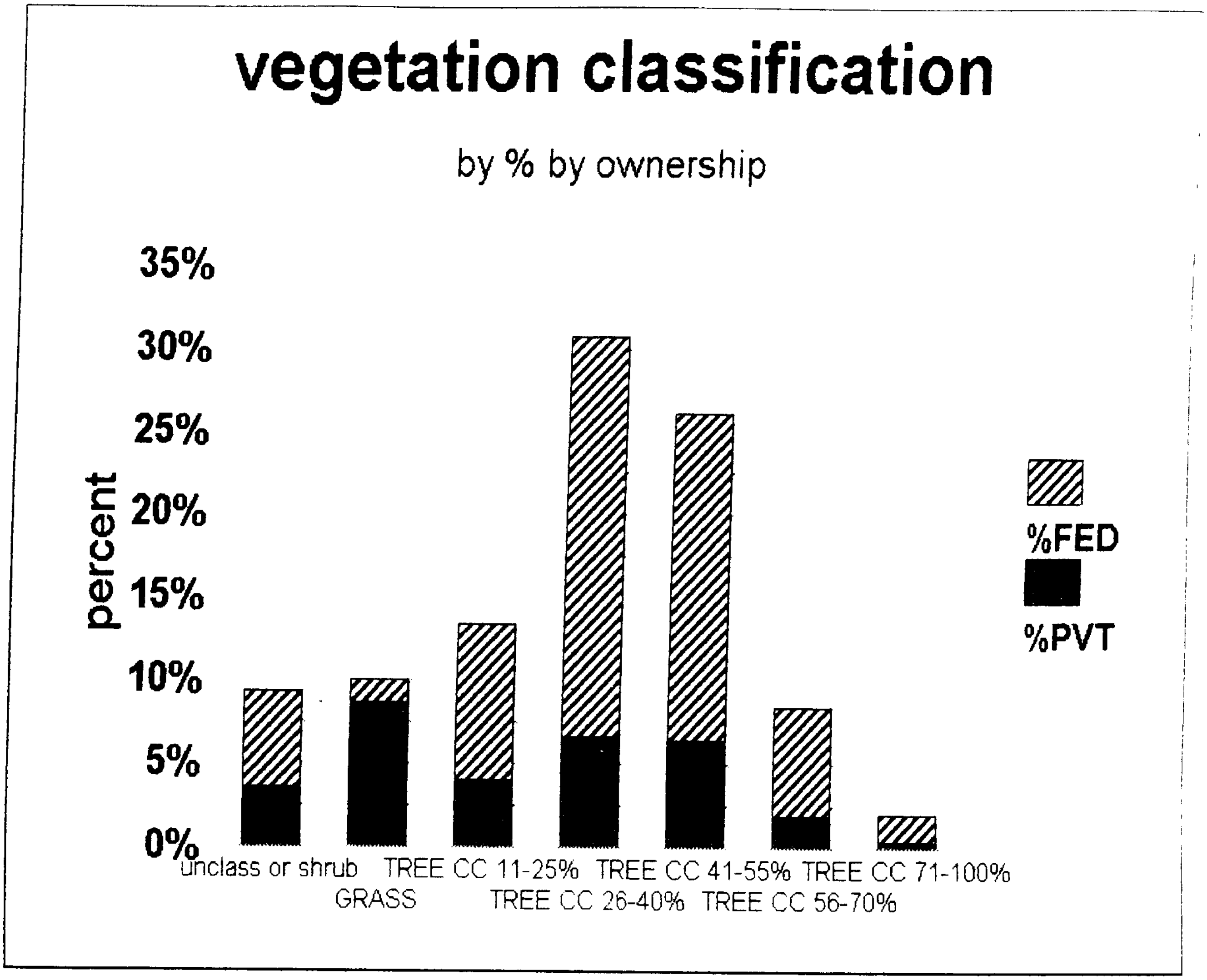
The vegetation classification by % ownership table below shows that most of the highly stocked tree stands are in federal ownership. The high percentage of "grass" type in private ownership is generally reflective of the type of land that became private due to its desirability as grazing land, and not necessarily any management practice.

Significant harvest has occurred on private industrial forest land since 1988, so they do not reflect the 1996 conditions. Minimal additional harvest, which would likely change the PMR classification, has occurred on FS lands since 1988 . Many of the FS acres cut since 1988 have been partial cuts, which generally result in no change of classification or decrease in the group, IE. CC 56-70% to 41-55% or similar changes.

Stress related conifer mortality has decreased conifer crown closure in some areas since the 1988 PMR classification. Change detection maps showing the extent are available at Chiloquin RD.

Little stress related conifer mortality has occurred on private lands since 1988. More had occurred in the lodgepole types prior to that time

The following chart shows the major vegetation classifications by federal vs non-federal land, based on 1988 PMR data.



vegetation classification
by % by ownership
percent
35%
30%
25%
20%
15%
10%
5%
0%
unclass or shrub
GRASS
TREE CC 11-25%
TREE CC 26-40%
TREE CC 41-55%
TREE CC 56-70%
TREE CC 71-100%
%FED
%PVT

Disturbance Factors

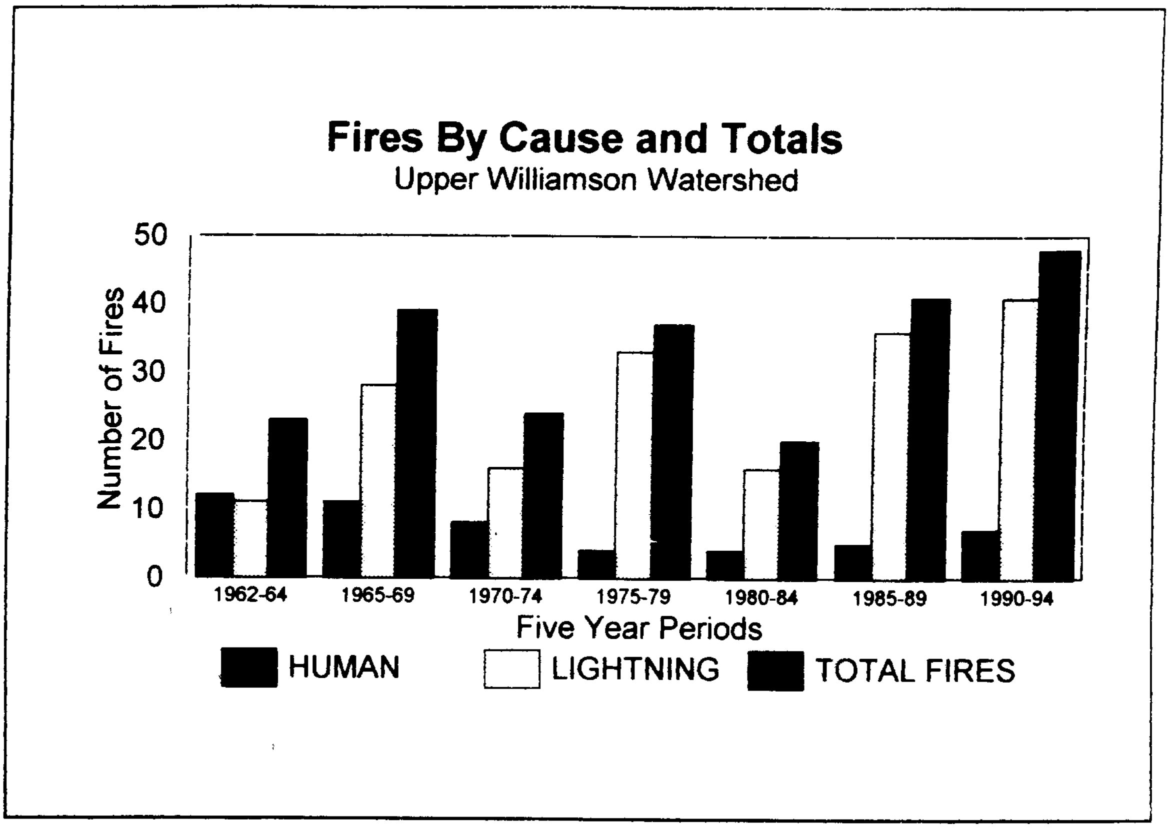
Type	Roads	Insects and Disease	Fire	Timber harvest	Grazing
Meso-riparian	Major impact from roads Vehicular travel often associated with firewood cutting or hunting This travel occurs more in the lodgepole dominated areas; however , roads in the non-lodgepole areas are often used as initial access.	Ongoing in lodgepole , estimate 50% of CLM3-11 type has sustained heavy mortality These types are extreme examples of encroachment and generally too wet to regenerate immediately to lodgepole	Wildfire almost non-existent Suppression impacts relatively minor as compared to other types May contribute to reduction of hardwood component	**Federal lands** Firewood cutting by individual permit is actively removing dead lodgepole Timber sale activity very limited **Private Land** Majority has been clearcut and converted back to grasslands for grazing.	Grazing, both domestic livestock and wildlife Predominantly in the lowlands in the non-lodgepole areas
Xero-riparian	Road density was limited by thick lodgepole stands However, as mortality occurs, firewood cutters are able to enter stands with vehicles, creating wheel tracks which encourage further vehicle use	Lodgepole mortality is ongoing, although less dramatic than in Mesoriparian areas 3-10% of trees over 7" die annually Cumulative effect is significant	**Wildfire** very limited **Suppression** has resulted in lodgepole domination of these areas, and significant reduction of aspen, willow, and understory shrubs, forbs, and grasses	**Federal Lands** Active firewood cutting Some commercial harvest where adjacent to dry lodgepole harvest areas **Private Lands** Majority has been clearcut and converted back to grasslands for grazing. Some conifer seedlings planted	Currently little grazing in the lodgepole areas Other areas are heavily impacted, and grazing maintains grass type
Lodgepole	Road densities are less limited by stand density Mortality still attracts firewood cutters, but impact is more dispersed	Lodgepole mortality is ongoing, but less than riparian types	**Wildfire** very limited **Suppression** Has resulted in significant increase of lodgepole in these areas	**Federal Lands** 25% has been harvested, approx 10% in some type of regen harvest **Private lands** Undetermined amount of harvesting has occurred	Currently very little grass production, so minor cattle use, and some sheep grazing on bitterbrush
Ponderosa pine	Increase in number and use of roads, average 5 mi/sq mi	Large proportion of high-risk stands, but current mortality is less than other types High mortality in sugar pine	**Wildfire** Fires have been small compared to adjacent areas Severity of fires has increased significantly in the last decade Risk of large, stand replacing fires is high **Suppression** has resulted in high conifer stocking on these acres	**Federal Lands** 50% has been harvested, in partial cut, large area salvage, shelterwood and overstory removal **Private lands** Undetermined amount of harvesting has occurred On tractor ground, most acres have had total overstory removal	Currently very little grass production so minor cattle use, some sheep grazing on bitterbrush

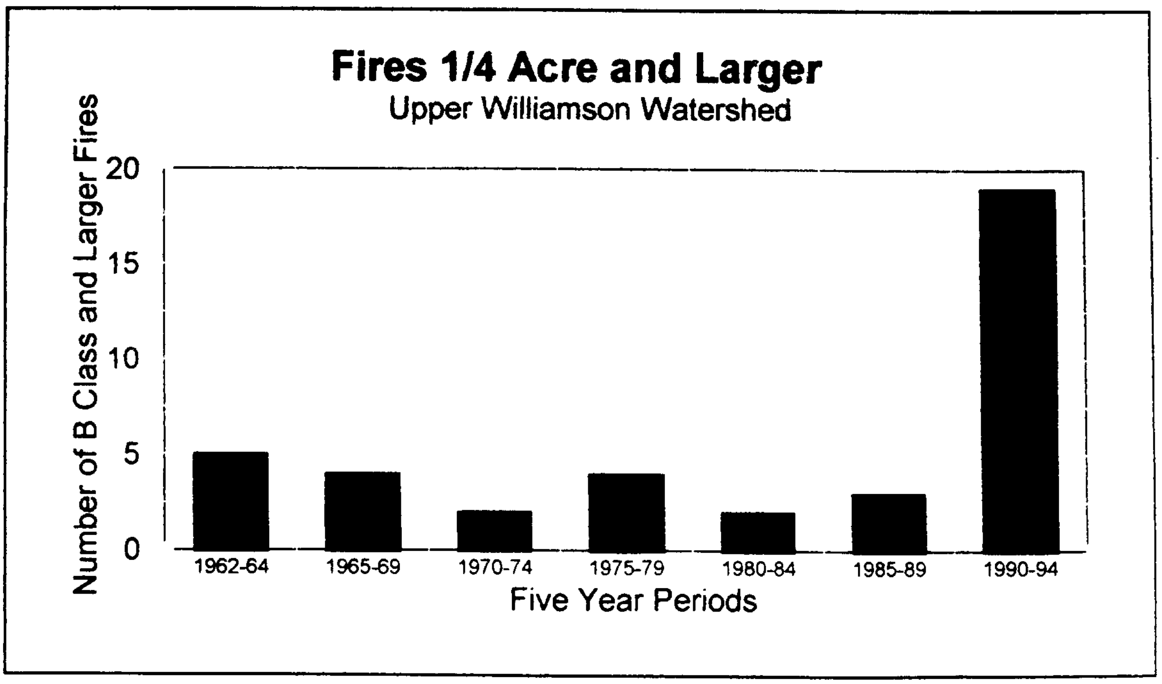
White Fir	Increase in number and use of roads, average 5 mi sq mi	Large proportion of high-risk stands Mortality ranges from moderate to locally severe High mortality in Sugar pine	**Wildfire** Fires have been small compared to adjacent areas Severity of fires has increased significantly in the last decade Risk of large stand replacing fires is high **Suppression** has resulted in extremely high conifer stocking levels on these acres	**Federal Lands** 30% has been harvested, via partial cut, shelterwood and overstory removal **Private lands** Undetermined amount of harvesting has occurred	Little grazing use
High Elevation Type	No roads	Almost non-existent	**Wildfire** is the disturbance mechanism for this type Natural fire regime characterized by infrequent, high intensity fires. At this time, these stands are not far out of synch with natural fire regime. **Suppression** Minimal impact, possibly delayed stand replacement fire	No harvesting	No grazing

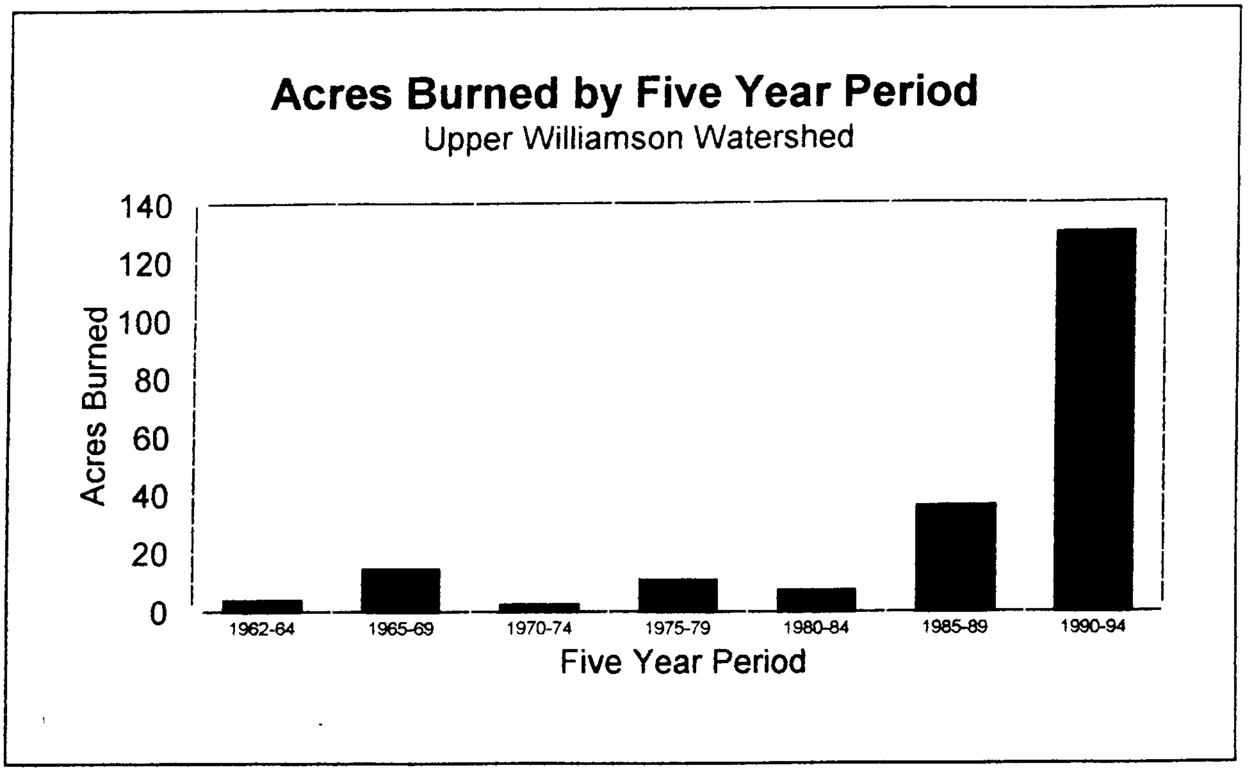
Haystack Draw meadow, typical of increased vehicle traffic in riparian areas.

Changes in Disturbance from changes in fire activity

The trend displayed in the three graphs is one of more fires and larger fires. Although not displayed in the graphs, the fires exhibited greater fire related conifer mortality during the last five year period (even relatively low intensity fires caused near total mortality to the overstory).







Note the involved boles of many of the trees, causing mortality even though the fire is not extremely intense.

Recommendations

Initiate program of rigorous understory and mid-story removals. Desired residual stocking levels should generally be half of desired stocking levels developed for intensive timber management.

Focus on least number of trees per acre needed to achieve stocking objective, not more frequent entries.

Abandon Uneven-Aged management with J-curves over 1 1 to reduce understory component.

Reintroduce surface fire at historical frequency/intensity/season levels.

Recognize conifer encroachment (lodgepole and ponderosa pine) on meadow and dry grassland/steppe types. Remove conifers from these sites and eliminate most conifer regen through repeated underburns, until conifers are a minor component of these types. Encourage hardwoods and native grasses.

Recognize that fringe and encroachment areas are good propagating grounds for insect population increases and give them high priority for harvest.

Consider sustainability of wildlife habitats and snag and down woody objectives over at least 200 year period to determine probability of success over time.

Develop forest plan revisions using least numbers of trees concept to meet stocking objectives. Don't use FVS or similar programs which encourage high number of stems and high stocking levels. Don't design management regimes that require all site capability to be devoted to conifers. Allow at least 20% of site capability to be used by non-conifers as a buffering system an to increase species diversity.

Take advantage of occurrences for stand openings, fires, harvest, to accomplish subsoiling if indicated and reinitiate underburning.

The Future, Winema National Forest, through the eyes of fire ecologist Tim Sexton.

IV. SOILS

Step 1: What are the dominant soil types and land forms within the watershed?

The geology of the study area is volcanic in parent material and landform. The highlands are basalt and andesite flow material dotted with eruptive centers and flow vents. The Williamson River Valley and most of the land west of the river is covered with sediments deposited from upland erosion and the eruption of Mt. Mazama. The valley bottom adjacent to Klamath Marsh consists of lake sediments from a period of higher lake levels.

The study area is predominantly composed of five soil groups: "A", soils formed in deep pumice and ash deposits from Mt. Mazama; "B", soils formed in pumice and ash over a buried residual soil; "G", soils formed in sediments accumulated in the valleys and low spots of the study area; "H", soils formed from a mixture of volcanic ash and weathered basalts and andesites; "R", soils formed from weathered basalts and andesites that have been subjected to glaciation.

The "A" type soils cover 19% of the study area, basically the northwest 1/4. These soils have low natural fertility, are deep enough to exclude plant roots from reaching the pre-Mazama soils, are excessively drained, have rapid infiltration rates, low detrimental compaction potential, low erosion rates (due to high infiltration rates and the gentle topography), and produce sand size sediments when eroded. Overland flow of snowmelt or even winter rain is very unlikely in these soils. Even runoff from naturally surfaced roads is minimal. Interception of groundwater flows by road cuts is also very rare and generally occurs only in wet spring and seep areas. Some localized overland flow is possible during intense summer storms when the dry soils have significantly lowered infiltration rates. Snowmelt, after wetting the upper soil horizons, moves rapidly through the soil profile into the water table or to the parent material interface.

The "B" type soils cover 49% of the study area. This soil type dominates the eastern ½ of the study area and most of the southern highlands. These soils have low natural fertility, are shallow enough to allow the deepest rooted native plants to reach the pre-Mazama soils, are excessively drained, have rapid infiltration rates, low detrimental compaction potential, low to moderate erosion rates, and produce sand size sediments when eroded. Overland flow from snowmelt or winter rains is not a frequent event in these soils, but is possible where the residual soil is relatively near the surface (20 inches or less). Some localized overland flow is possible during intense summer storms when the dry soils have significantly lowered infiltration rates. Snowmelt, after wetting the upper soil horizon, moves rapidly through the remainder of the pumice to the residual soil interface, then along this interface to stream banks or spring locations. Some of the water will move into the residual soil and into the groundwater table In the areas where "B" soils are shallowest, it is possible for road cuts to intercept groundwater flows along the pumice/residual soil interface. This intercepted groundwater will most likely become groundwater again after a short distance of flow in the road ditch.

The "G" type soils cover 12% of the study area, forming the meadows and valley bottoms. These soils have low to moderate natural fertility, are deep enough to exclude plant roots from reaching the pre-Mazama soils, are poorly drained, have rapid infiltration rates, moderate detrimental compaction potential, moderate potential for gully erosion, and produce sand and silt size sediments when eroded Although these soils have high infiltration rates, their slope positions (valley bottoms) can result in maintenance of high water tables. These are locations where long term intermittent or perennial flows may occur These are also the soils that are likely to respond to heavy use with gullying and downcutting of existing stream channels Overland flow is a common sight during spring snowmelt or heavy rainfall events Road cuts often intercept groundwater, which occasionally flows on the surface for considerable distances before returning to the groundwater system

The "H" type soils cover 10% of the study area. This soil type is associated with the high elevation lands along the eastern boundary of the study area and at the top of Fuego Mountain These soils have moderate natural fertility, are well drained, have moderate to rapid infiltration rates, moderate to high detrimental compaction potential, low to moderate erosion rates, and produce sand and silt size sediments when eroded. Overland flow from snowmelt or winter rains is not a frequent event in these soils, but is possible where bedrock is near the surface, or is exposed in rock outcrops or in road cut banks. Some localized overland flow is possible during intense summer storms, when the dry soils have significantly lowered infiltration rates. Snowmelt, after wetting the upper soil horizon, moves rapidly through the remainder of the soil profile to the bedrock interface, then along this interface to stream banks, springs, or road cut banks. Groundwater intercepted by road cut banks will often move along the road ditch until it intercepts a stream channel.

The "R" type soils cover 5% of the study area. This soil type is located at the top of Yamsay Mountain and has been subjected to glaciation. These soils have high natural fertility, are well drained, have rapid infiltration rates, moderate to high detrimental compaction potential, low to moderate erosion rates, and produce sand and silt size sediments when eroded. Overland flow from snowmelt or winter rains is not a frequent event in these soils, but is possible where bedrock is exposed in rock outcrops or in road cut banks. Some localized overland flow is possible during intense summer storms when the dry soils have significantly lowered infiltration rates. Snowmelt, after wetting the upper soil horizon, moves rapidly through the remainder of the soil profile to the bedrock interface, then along this interface to stream banks, springs, or road cut banks. Groundwater intercepted by road cut banks will move along the road ditch until it intercepts a stream channel.

The remaining 5% of the study area is composed of several miscellaneous land types and soil complexes, none of which is of sufficient extent to have any effect on the hydrology of the study area.

Step 2: What are the current conditions and trends of the dominant soil types and land forms?

Soil compaction has taken place on most of the study area. The compaction on the Chemult District is well documented but the extent and degree of compaction on the Chiloquin District has yet to be determined. Appendix F documents the level of compaction in tested areas of both districts. It appears Chemult has a greater level of compaction. Out of 1330 acres sampled on Chemult, approximately 30% of the acreage was found to have heavy compaction, 35% of the acreage was found with modrate compaction, and 35% was found with light to no compaction. Although no detrimental compaction was found on the Chiloquin district, the Chiloquin portion of the watershed area was undersampled and, therefore, the results are inconclusive. Although there *are* areas that have compaction levels exceeding Forest Plan guidelines of 20% increase in bulk density over 20% of a given area, there is some question as to whether these levels are actually detrimental. There are areas where below normal tree growth rates have been documented, but compaction has not been proven to be the cause It is usually due to the planting of ponderosa pine in cold air drainages and or in areas where thermal cover has been removed, allowing cold air to settle in basins

The only obvious locations where soil compaction has resulted in accelerated erosion are meadows that have been heavily impacted by domestic livestock and vehicle use. Meadows ("G" soils) are more susceptible to compaction due to the silt component of texture Silt is the most compactable of the three components of texture - sand, silt, and clay The non "G" type in the analysis area are composed primarily of coarser sands and gravels. Therefore, the high water infiltration rates of the non "G" type soils are higher and seem to be sufficient to handle storm runoff and snowmelt even after being compacted. This holds true in all but the most extreme cases.

In short, most soils within the study area do show signs of moderate to heavy compaction but the detrimental effect is not known. The charts below identify which soils have low to moderate and moderate to high compaction ratings and compaction data is found in Appendix D.

Soils Least Susceptible to Compaction

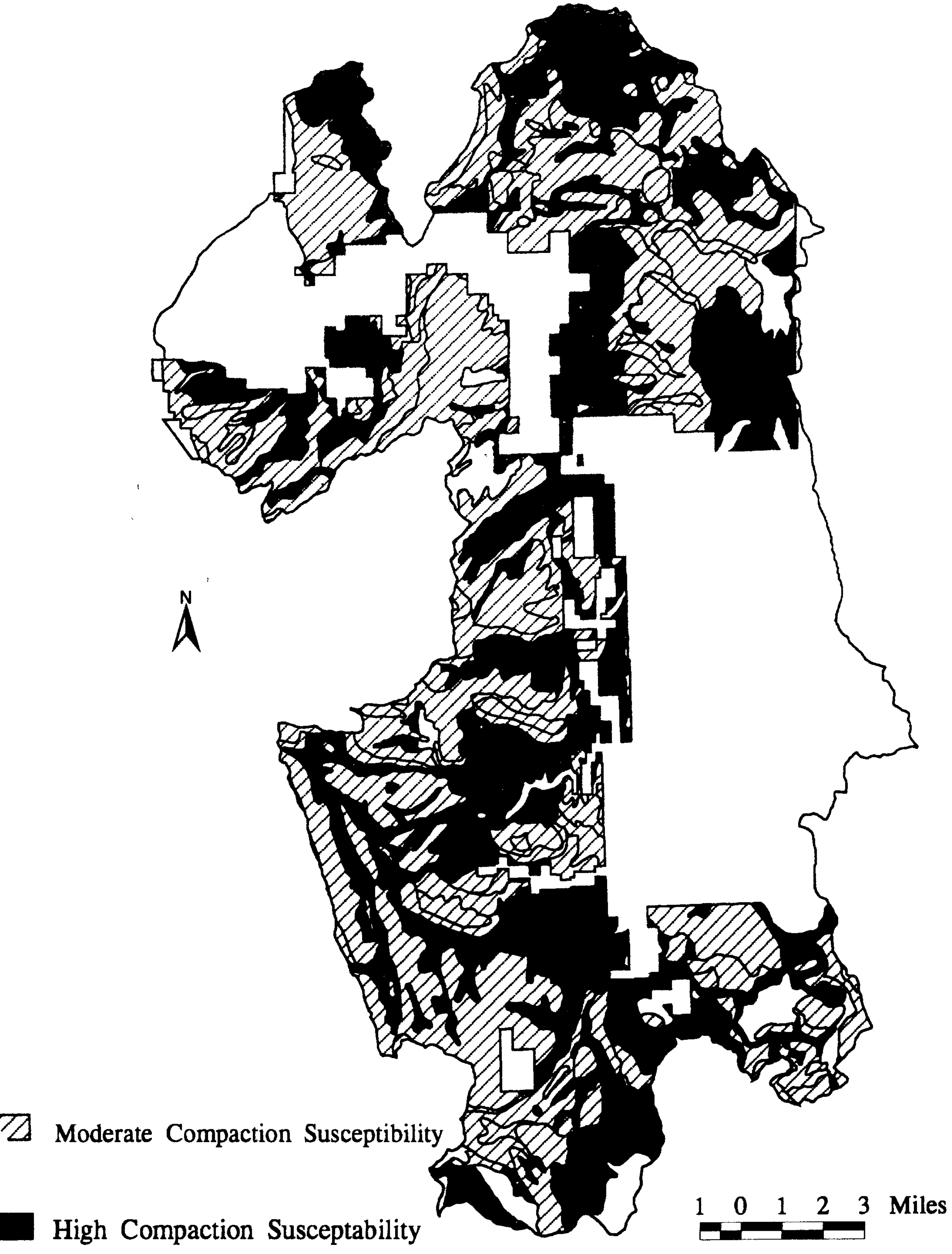
A Group	B Group	H Group	Land Types	Soil Complexes
A1, A4, A8	B1, B4, B7, B8	H2, H3, H5, H6	6, 20	A4B4, B4H5, B4H6, 6A8, 4B4

Soils More Susceptible to Compaction

A Group	B Group	G Group	R Group	X Group	Land Type	Soil Complexes
A2	B2,B3	2, G2, G3	R8,R11	X2	3	A2A4, 6A2, B2B4, B2H5, 2G3, A4G2, A6G2, 2G1, B8G1, B4G1, B7G1, A8G2, B3B5, 4R9

The map on the following page shows the areas within the watershed with moderate to high compaction ratings.

Soils Susceptibility to Compaction



Soils and Land Types More Susceptible to Erosion Hazards

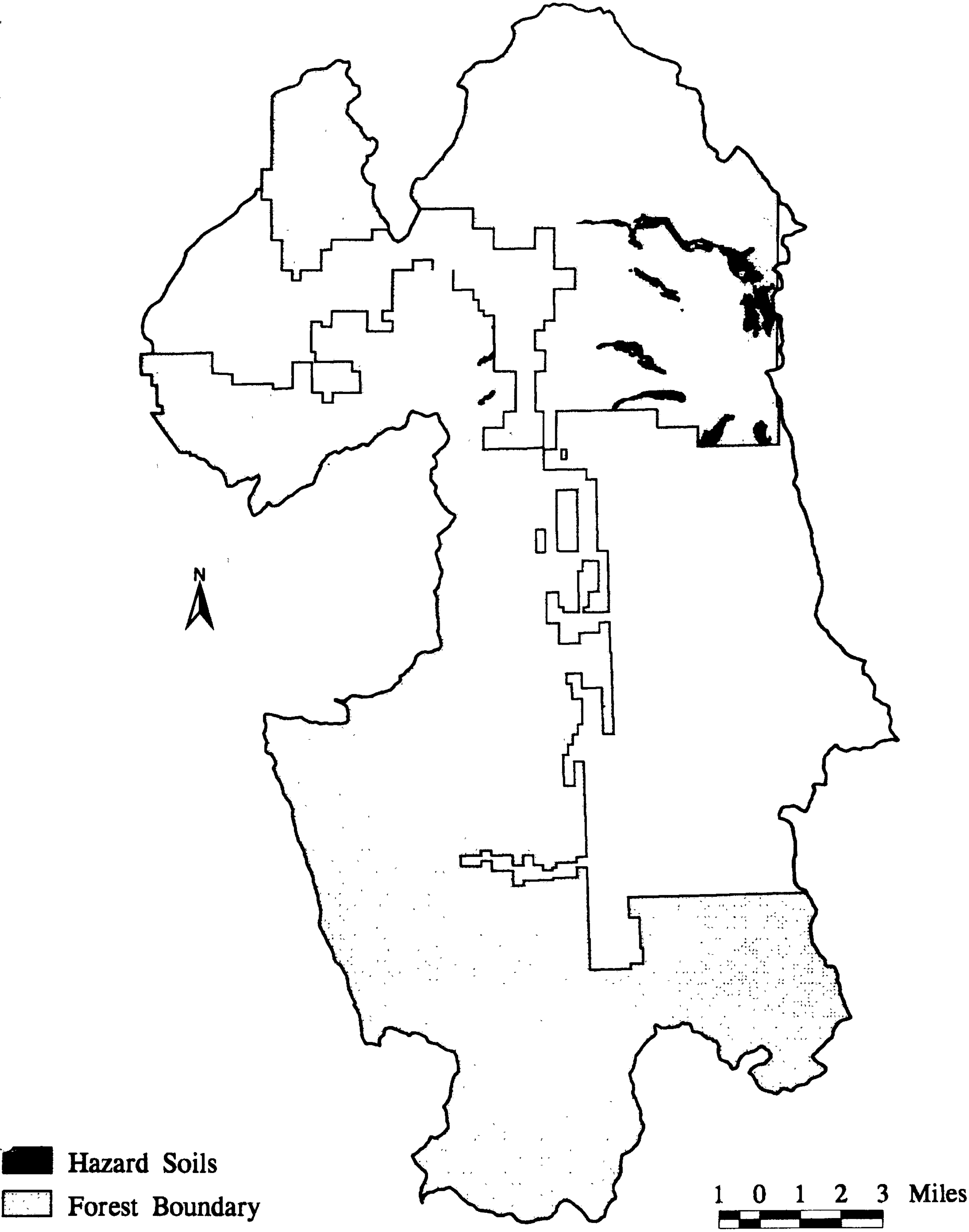
Soil & Land Types	Sheet Erosion	Gully Erosion	Wind Erosion
A Soils	A4,5,11,12,**14**,15,	A2,3,16	A1,4,5,6,8,10,
A complexes*	A2A4, A3A5, A4A6, A4B4, A4B5, A4G2, A5A6, A5B5	A2A4, A4G2, A6G2, A8G1, A8G2, A8G3	A2A4, A3A5, A4A6, A4B4, A4B5, A4G2, A5A6, A5B5, A6A8, A6G2, A8A10, A8D1, A8G1, A8G2, G3, A10B8, 6A8
B Soils	B4,5,**6**,7	B2,3	B1,4,5,7
B complexes*	B2B4, B4G1, B4G2, B4H2, B4H5, **B4H6**, B7G1	B2B4, B4G1, B4G2	B1B8, B2B4, B4G1, B4G2, B4H2, B4H5, B7G1
G Soils		G1, G2, G3	
G Complexes*		G2G3, 2G2, 2G3, 6G2, 15G3	
H Soils*	**H3**, H5, **H6**		
R Soils	R8 on 20-35% Slopes **R9, R11** on 30-60% Slopes		R11
R Complexes	4R9		
X Soils	X2		
Misc. Land Types	12, 14, 20	2, 3	14, 20

*Soils listed in " **Bold type**" are rated high to severe in the erosion category that they occur in.*

** Soil complexes are only listed once, under the erosion hazard that may exist within that soil complex. Example: "A8G2" is listed under the A complexes, and is <u>not</u> listed again under the "G Complexes".*

The map on the following page shows areas within the watershed with high to severe erosion potential, located on 30%-60% slopes.

High-Severe Soil Erosion Potential on 30%-60% Slopes



Step 3: What are the historical conditions of the dominant soil types and land forms?

Basic soil characteristics have not changed substantially from those of the time period prior to aggressive use of the timber and grazing resources. The lack of fire since effective suppression efforts began shortly after the turn of the century have allowed the litter and fermentation layers of all soil types to enrich over time. This may have had some effect on water holding capacity and nutrient availability.

Soil compaction from timber harvest and grazing activities may have had some effect on the growth rates of some plants, but not to the extent to be obvious. Compaction may also have had some affect on the infiltration rates of snowmelt waters. Again, there are no obvious signs that the reductions have been sufficient to alter hydrologic function or accelerate erosion rates.

Step 4: What are the natural and human causes of change between the historical and current soil conditions? What are the influences and relationships between the soil conditions and other ecosystem processes?

Timber harvest, grazing, and road construction have resulted in compaction of the natural soils. The extent and degree of compaction across the Upper Williamson Analysis Area has yet to be determined. There are areas that have compaction levels exceeding Forest Plan guidelines, but there is some question as to whether these levels are actually detrimental.

One of the primary indicators of detrimental soil impact is soil bulk density. Bulk density is a measure of the amount (mass) of soil occupying a unit volume. Any mechanical management will compress the soil, increasing the amount of soil occupying the unit volume, subsequently increasing the bulk density. This is the dynamics of compaction. Compaction results in decreased pore space, resulting in decreased water and organic matter holding capacity, restricted water and air movement, and decreased root growth. Productivity decreases with increasing bulk density; therefore, monitoring of bulk density in the watershed remains crucial.

The methodology of bulk density measurements adopted on the Winema National Forest are those developed as Regional standards. These procedures were developed for the soils around the Portland area. Similar techniques are used throughout the country. The soils on this forest, particularly in the Chiloquin and Chemult districts, share few physical and chemical similarities with soils found throughout the rest of the country. Particularly important with respect to bulk density is the varying density of the soil particles. This variation is due to the vesicular nature of pumice particles. Standard bulk density techniques, including Region 6 standards, assume a constant particle density. The same assumption on soils resulting from the Mazama eruption yield inconsistent and inaccurate values.

Presently there are no known areas showing detrimental effects from compaction (exceptions being cattle trails and roads in meadows). This is not to say they don't exist, just that none have been identified at this time. In areas where below normal tree growth rates have been documented, it is usually the result of planting ponderosa pine in cold air drainages and/or in areas where thermal cover has been removed, allowing cold air to settle in basins. However, the levels of compaction do not appear to be detrimental to the basic function of other ecosystem processes.

Primary causes for the current levels of compaction are assumed to be timber harvest, road construction and grazing activities from the past 100 years

Recommendations

Continue to monitor soil conditions at the basic level for productivity, erosion rates, water holding capacity, etc.

Develop a new procedure to determine bulk density in ashy and pumiceous soils. Perhaps a method can be developed where detrimental bulk density values can be determined by comparing the bulk density to a predetermined bulk density curve of uncompacted soils. The ideal bulk density curve would take into account the percentage of gravel content.

Determine conclusively the affect changes in bulk density have on productivity and adjust allowable compaction limits on pumiceous soils accordingly.

V. WATER QUALITY

Step 1: What beneficial uses dependent on aquatic resources occur in the watershed? Which water quality parameters are critical to these uses?

Beneficial uses of aquatic resources include: fishing, irrigation for crops and livestock production, harvest of wild plants such as wocus, forage production for game species of terrestrial animals, and production of timber.

Critical water quality parameters for beneficial uses include: temperature, quantity, chemistry (especially elements that limit or increase plant production), and particulate matter including sediment and suspended solids.

Step 2: What are the current conditions and trends of beneficial uses and associated water quality parameters?

Water quality is generally good for all uses except the most critical of high quality water, fish production. The problem areas for the fishery resource include temperature, quantity, and sediments. Water chemistry affects the aquatic flora.

Temperature

Water temperatures in the river increase the further downstream one gets from a water source, which are usually springs. In the vicinity of the Deep Creek confluence, water temperature, along with a host of other habitat parameters, degrade to a point that has a negative effect on the population density of the native rainbow/redband and brook trout, the two major species of game fish in the Williamson. According to USFS data collected from 1992 to 1994, the upper Williamson River near Rocky Ford exceeded the Oregon Department of Environmental Quality seven day average maximum daily temperature standard of 64 F (17.8C) from June through August. Standards were also exceeded during May 1992. Flow quantities for June through August of the drought years 1992 and 1994 were 68% and 70% of the twenty-one year average (1974-1994) respectively. 1993 flows were 91% of the average. As expected the 1993 temperatures are lower than either 1992 or 1994. Daily high temperatures for 1993 were usually 67-68 F as compared to 70-73 F in 1992 and 1994.

The tributary streams east of the River draining Yamsay Mountain and Booth Ridge do not appear to suffer from temperature problems, except for those segments that are within the Williamson River Valley. For the most part, these segments have been diverted for irrigation, which will tend to increase surface water temperatures. The stream systems west of the river are intermittent and ephemeral in nature. Any surface water in these systems will naturally go through the full range of temperature conditions, as spring runoff diminishes to zero, and mean daily temperatures increase.

The trend for water temperature is likely improving due to shade producing habitat improvements such as livestock exclosure from the riparian zones which improve temperature profiles for fish. With improving temperature profiles, and a fairly steady condition of other water quality parameters (see below), the fishery resource is expected to improve in the future The rate of improvement depends on the continued improvement of the contributing parameters.

Quantity

Water flow quantities are currently impacted by flood irrigation practices, channel incision which reduces effective floodplain, and effects due to increased timber density. Flood irrigation reduces flows due to increased evaporation, due to the water being spread over a greater surface area than naturally exists in stream channels during the warm part of the year. Channel incision causes the floodplain of the river to become less accessible to the river during high water events, that otherwise would store runoff water within the floodplain. Impacts due to increased evapotranspiration caused by overstocked forests have been discussed in the Hog, Yoss and Skellock Watershed Analysis, and have not proven to be an issue in this analysis. In summary, evapotranspiration withdraws available moisture from the aquifer during the growing season, when low flows are expected. Conversely, a certain minimum level of tree canopy cover provides shade that slows snowmelt in the spring, which tempers spring runoff rates, thus restocking groundwater reserves instead of increasing spring runoff. Logically, shade provided by the timber canopy is of greater importance in landscapes such as the study area, dominated by low angle topography, than in areas of greater relief that produce more shading due to landscape morphology. Water quantity is probably unchanging for the most part due to few changes in the causative factors.

Sediment

Sediment loads are generally high in the Williamson River and in private sections of the Yamsay tributaries, as a result of factors such as: streambank erosion due to the combined effects of a fluctuating water table, livestock grazing in the riparian zone, and the lack of riparian hardwoods. These factors expose raw stream banks to erosion by the river. In addition to bank erosion, once a sufficient volume of soil is deposited in the channel, the submerged aquatic macrophytes are smothered and their roots no longer maintain the integrity of soils on the channel bottom. Timber harvest and excessive road construction also contribute to sediment loading by destabilizing soils and causing erosion. Sediments fill in deeper hiding cover for fish and smother aquatic plants that provide cover and forage substrate. Sedimentation may be slowing and improving due to efforts such as fencing riparian areas to prevent livestock from eroding stream banks.

Chemistry

At the Head of the River Spring the USGS (1992) has measured total phosphorus concentrations at 0.05 milligrams per liter (parts per million), dissolved orthophosphate at 0.04 mg/L, total Kjeldahl (organic plus inorganic) nitrogen at less than 0.20 mg/L, ammonia nitrogen at 0.02 mg/L, and dissolved nitrite plus nitrate at 0.168-0.181 mg/L indicating the system to be somewhat nitrogen limited. Seven river miles below the head of the river is Wickiup Spring which supplies most of the river's water volume. No water chemistry data is available at this time; therefore it is assumed that Wickiup Springs has water chemistry similar to the Head of the River Spring. Accompanying data from 19 river miles downstream of Head of the River Spring, at the FS road 49 crossing, indicate an approximately 97% reduction in dissolved nitrate and nitrite to <0.005-0.008 mg/L, and slightly reduced orthophosphate (12%) which indicates a very significant nitrogen limitation. Nitrate and nitrite are the direct nitrogen sources for photosynthesis in most plants. Any additional nitrogen introduced via fertilization or metabolic wastes of livestock or humans, concentrated near streams, would contribute to eutrophication of the system. Small increments of biological enrichment due to eutrophication will increase existing stands of aquatic plants. Increased levels of eutrophication will clog the channel with plants, ultimately causing deficits in oxygen concentrations which can eventually have a major negative impact on aquatic fauna.

Since 97% of the available nitrogen is consumed in twelve miles of river, this nutrient limitation may have caused a reduction of aquatic macrophyte standing crop in much of the lower section of the river since the reference era. If the river channel was narrower, with more overhanging banks and riparian cover, then shade would limit some plant production and nutrients required to support aquatic plants would likely be available further downstream.

Step 3: What were the historical water quality characteristics of the watershed? What are the natural and human causes of change between historical and current water quality conditions?

Water quality parameters are highly interactive with each other, as well as other factors such as land use and modification. Management practices in general may affect water chemistry, temperature, and turbidity (sediment loading). Within the study area, domestic livestock grazing, pasture irrigation, logging activities, developed camping, and road construction and maintenance are the management practices of concern.

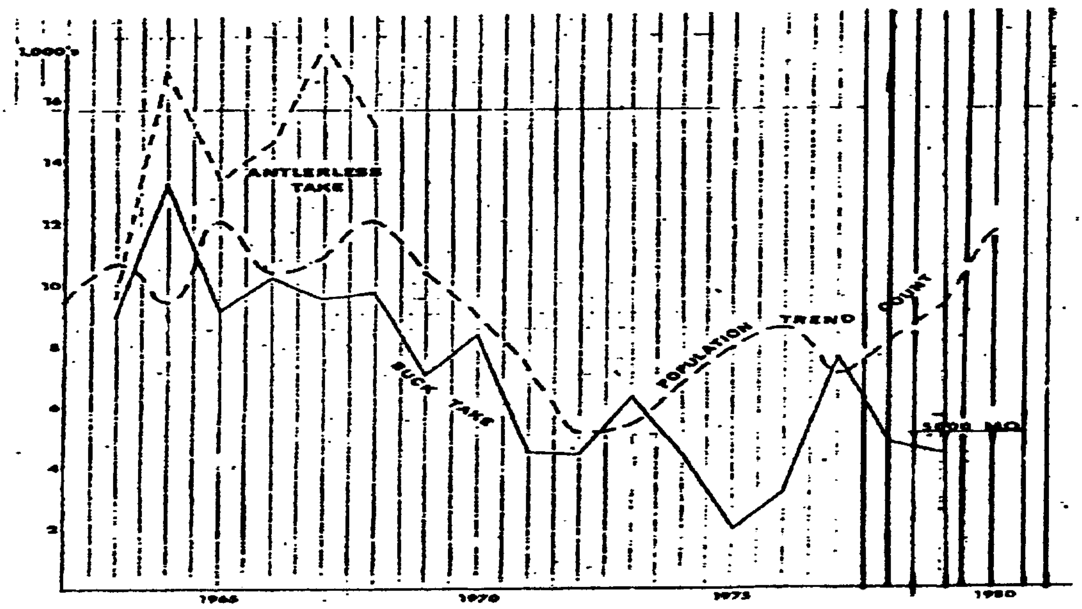
Temperature

Water temperature was historically lower due to higher levels of instream shade, greater water quantities, and narrower, deeper channel morphologies.

The loss of stream bank vegetation on the Williamson River since the turn of the century, along with segments of wider and shallower channel, have elevated temperatures above that of the river's natural channel form. The isolation of the river from tributaries such as Jackson, Irving, Aspen, and Deep Creeks has likely added to the temperature problems.

Summer water temperatures have probably increased since the reference era. Causes include increased solar exposure due to flood irrigation and channel widening, less summer flow quantity due to evaporation caused by flood irrigation and channel incision, and a drastic reduction in shade due to the relative absence of riparian hardwoods and destruction of overhanging banks. A lowered water table offers less temperature buffering capacity than a more saturated aquifer. Therefore, summer temperatures are probably higher and winter temperatures may be lower than during the reference era.

Irrigation of pasture lands in the Williamson River Valley by diverting waters from Jackson, Irving, Aspen, and Deep Creeks, has reduced the inflow of low temperature waters to the Williamson River during the critical summer months. The effect of these cold waters on water temperatures in the river would be localized to the confluence of the tributaries and short distances downstream.



Graph from the Winema Project Report, 1980, Jack Inman, WNF Biologist
Graph shows deer population trend and harvest, 1960 - 1980.

The table below shows the rapid decline in analysis area deer herd sizes mentioned earlier, followed by a period of recovery, then another period of decline to the present time.

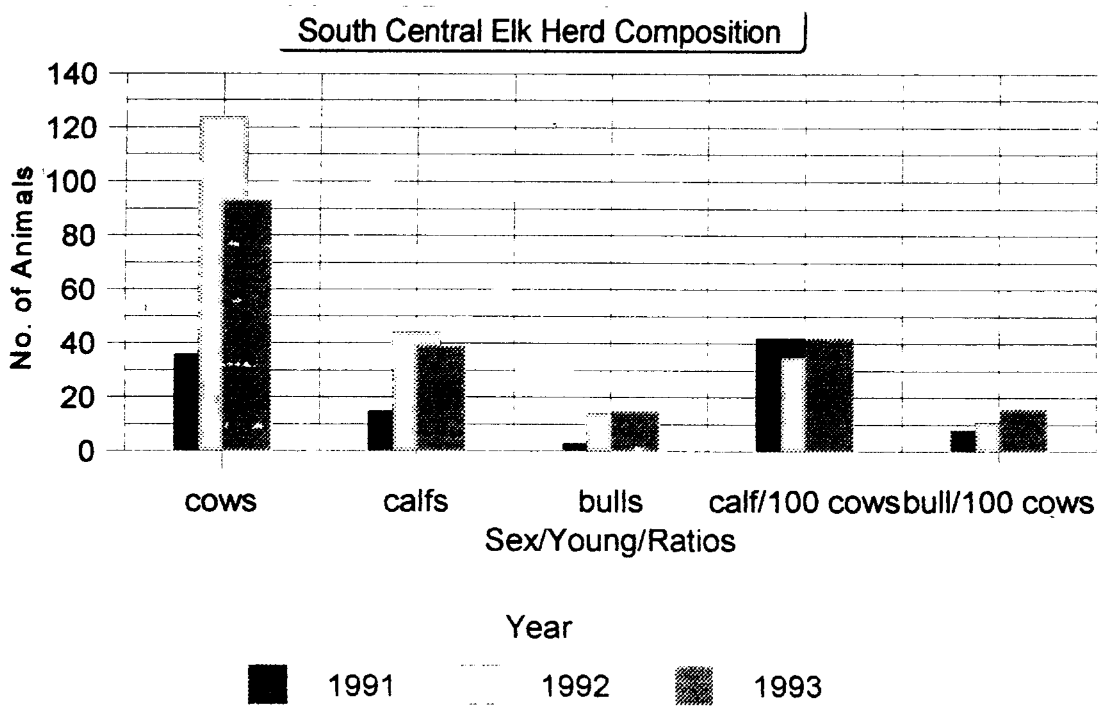
Deer Herd Summary Info from ODFW For the Sprague, Silver Lake Fort Rock Herd Units

Herd Unit/Year	Total Count	Deer/Mile	% Survival	% Hunter Success
*Silver Lake/1966	3821	26.9	55%	Not Available
Silver Lake/1970	2495	17.6	81%	32%
Silver Lake/1975	949	14.7	64%	14%
Silver Lake/1980	1571	24.4	71%	Not Available
Silver Lake/1990	3840	59.1	90%	22%
Silver Lake/1995	2442	37.6	52%	Not Available
**Sprague/1987	April Count 792	Not Available	80%	23%
Sprague/1990	April Count 792	Not Available	75%	22%
Sprague/1995	April Count 770	Not Available	62%	28%
***Fort Rock/1966	2117	13.2	Not Available	Not Available

Fort Rock/1970	Not Available	9.3	93%	34%
Fort Rock/1975	777	12.8	70%	Not Available
Fort Rock/1980	2021	33.4	95%	Not Available
Fort Rock/1990	1913	31.9	80%	24%
Fort Rock/1995	1247	20.8	63%	Not Available

*Percent of Analysis Area in Silver Lake Unit = approximately 49%
**Percent of Analysis Area in Sprague Unit = approximately 50%
***Percent of Analysis Area in Fort Rock Unit = approximately 01%

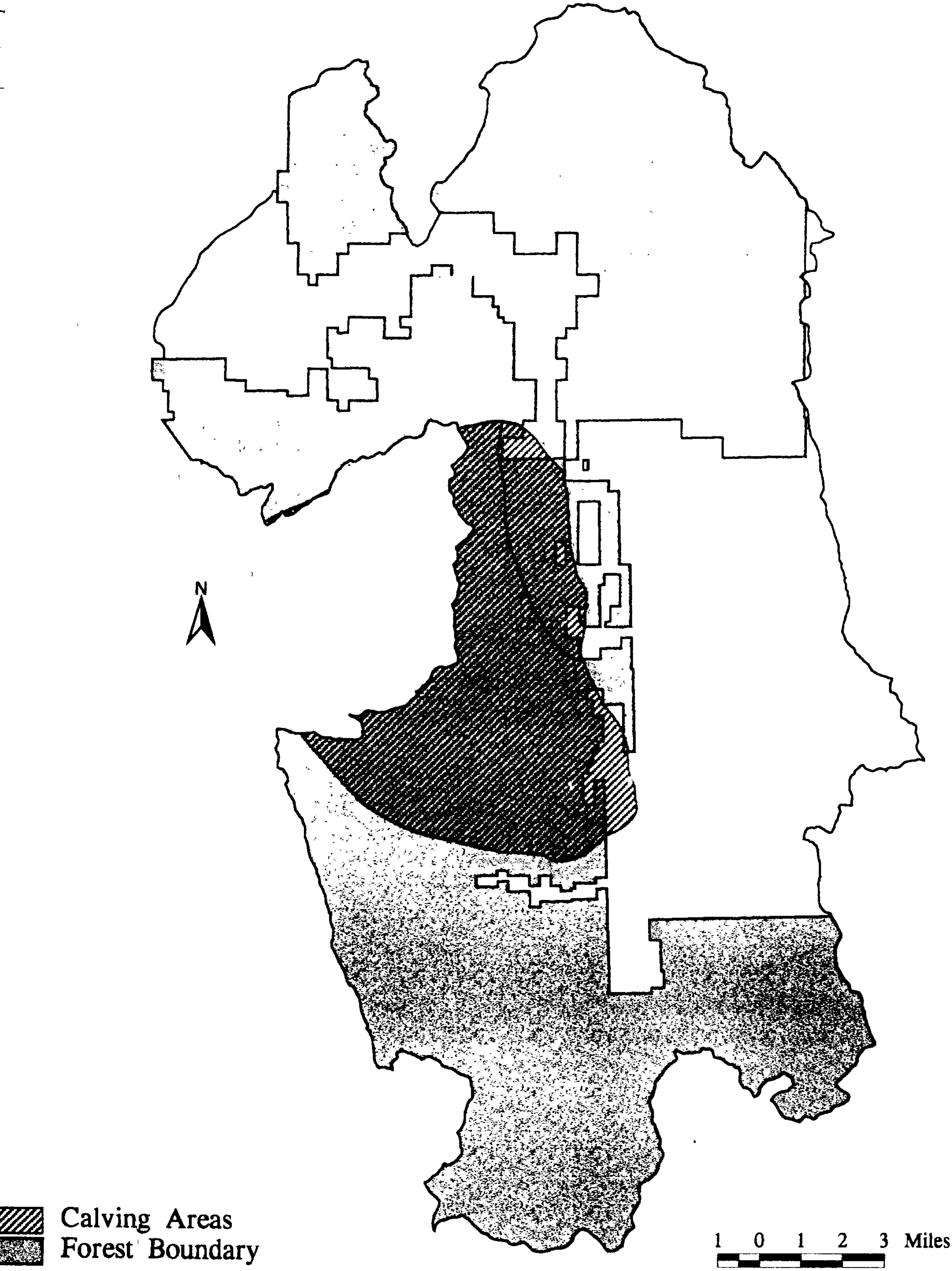
The table below shows a more recent general increase in elk populations.



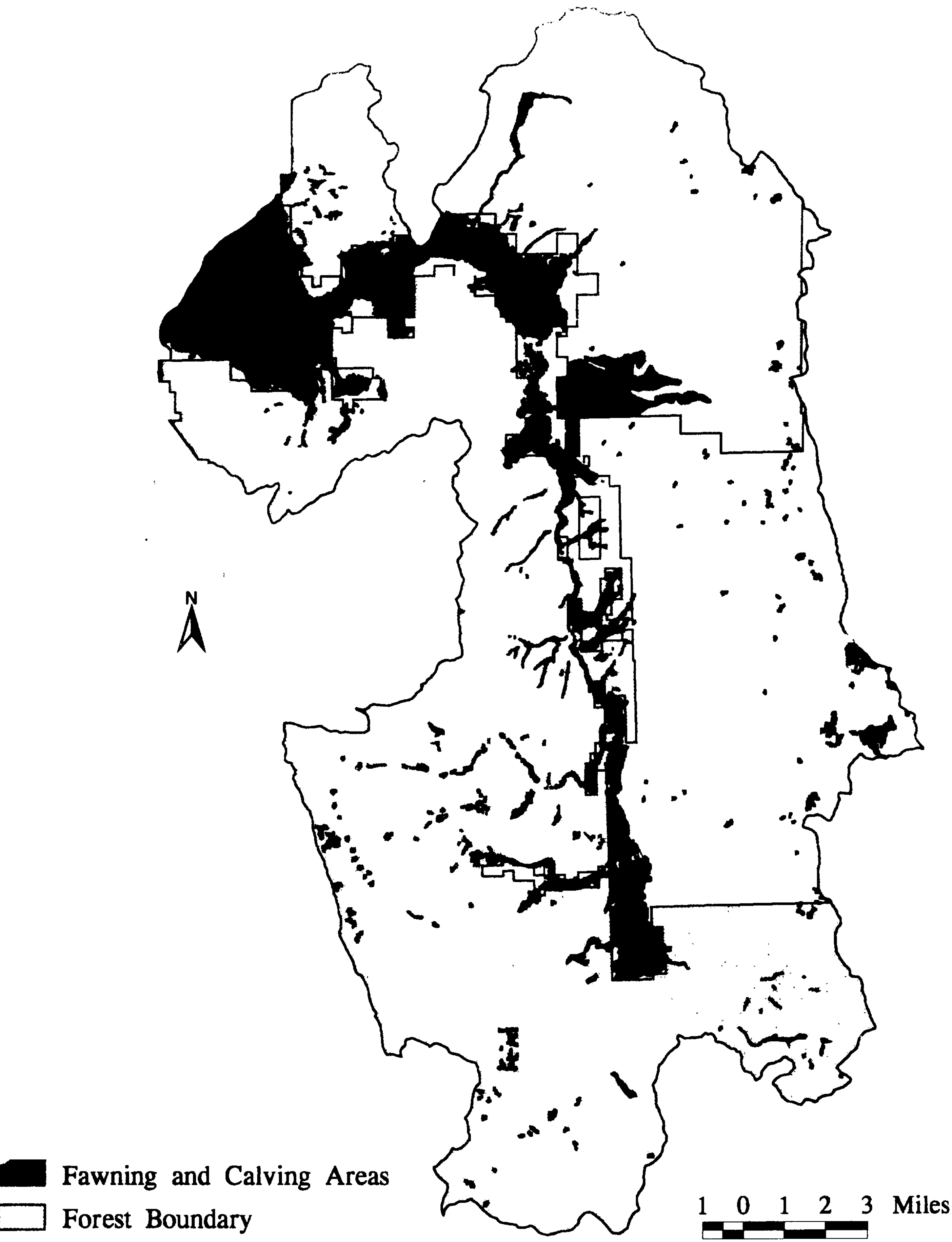
Preliminary information collected from Fort Rock/South Central Elk Telemetry Study by Foster, 1994. Report documents increase in elk no's. Graph shows results from Combined South Central Elk Herd.

Both deer and elk are distributed across the entire analysis area, since both species are considered generalist in nature. Spring and early summer use is primarily associated with meadows and wetter riparian areas for both does and cows (See Primary Elk Calving and Deer Fawning Area maps on following pages). When the bitterbrush starts to increase in palatability and nutritional value in mid-July, deer tend to move to these areas until migration to winter ranges occurs (Oct-Nov). Elk tend to utilize the riparian areas throughout the entire year, unless conditions (man, severe weather, forage availability) force them to move to other areas (See Bitterbrush and Early Successional Forage Areas maps on the following pages, and Riparian Areas map in Section III).

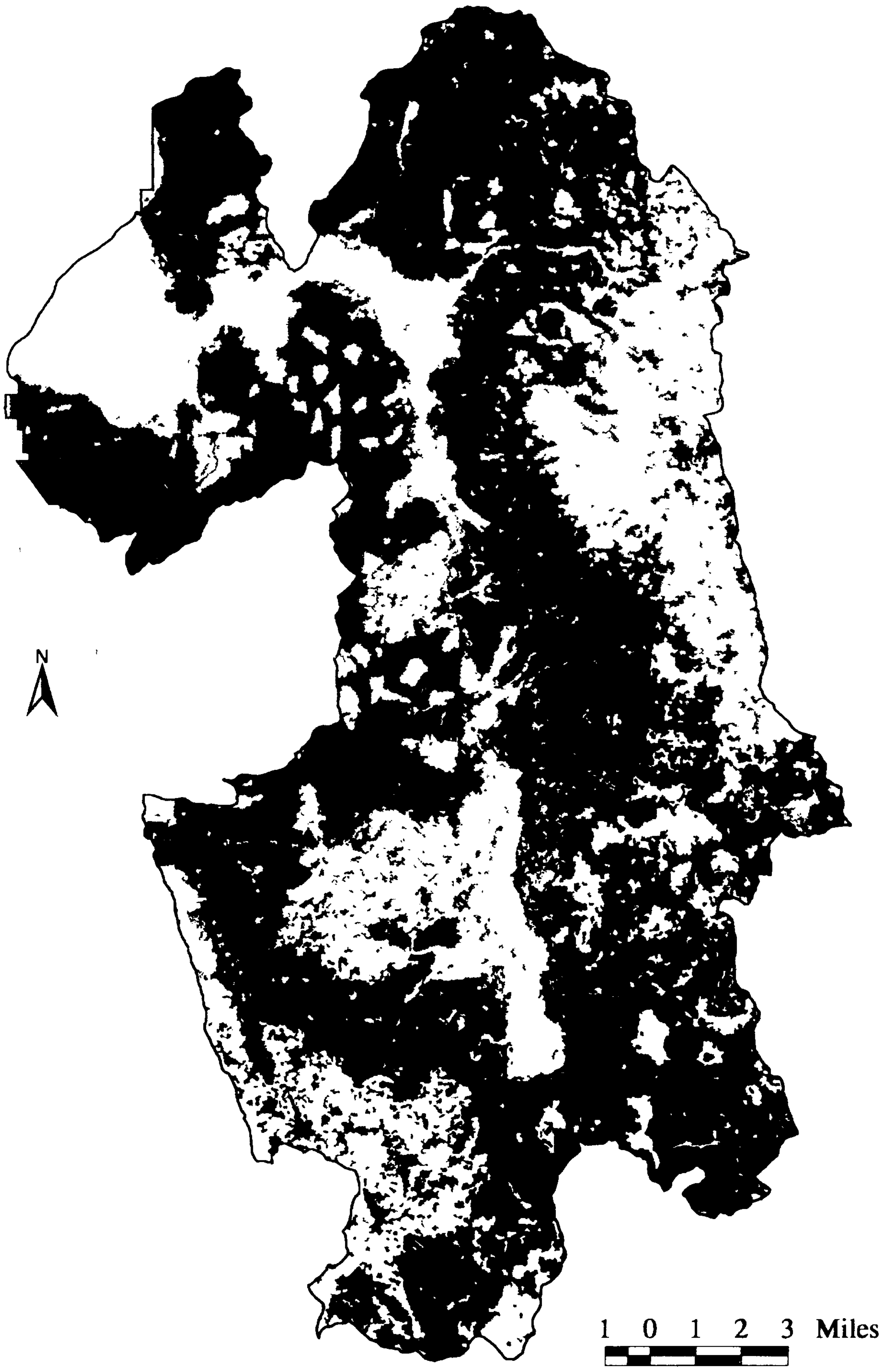
Primary Elk Calving Areas



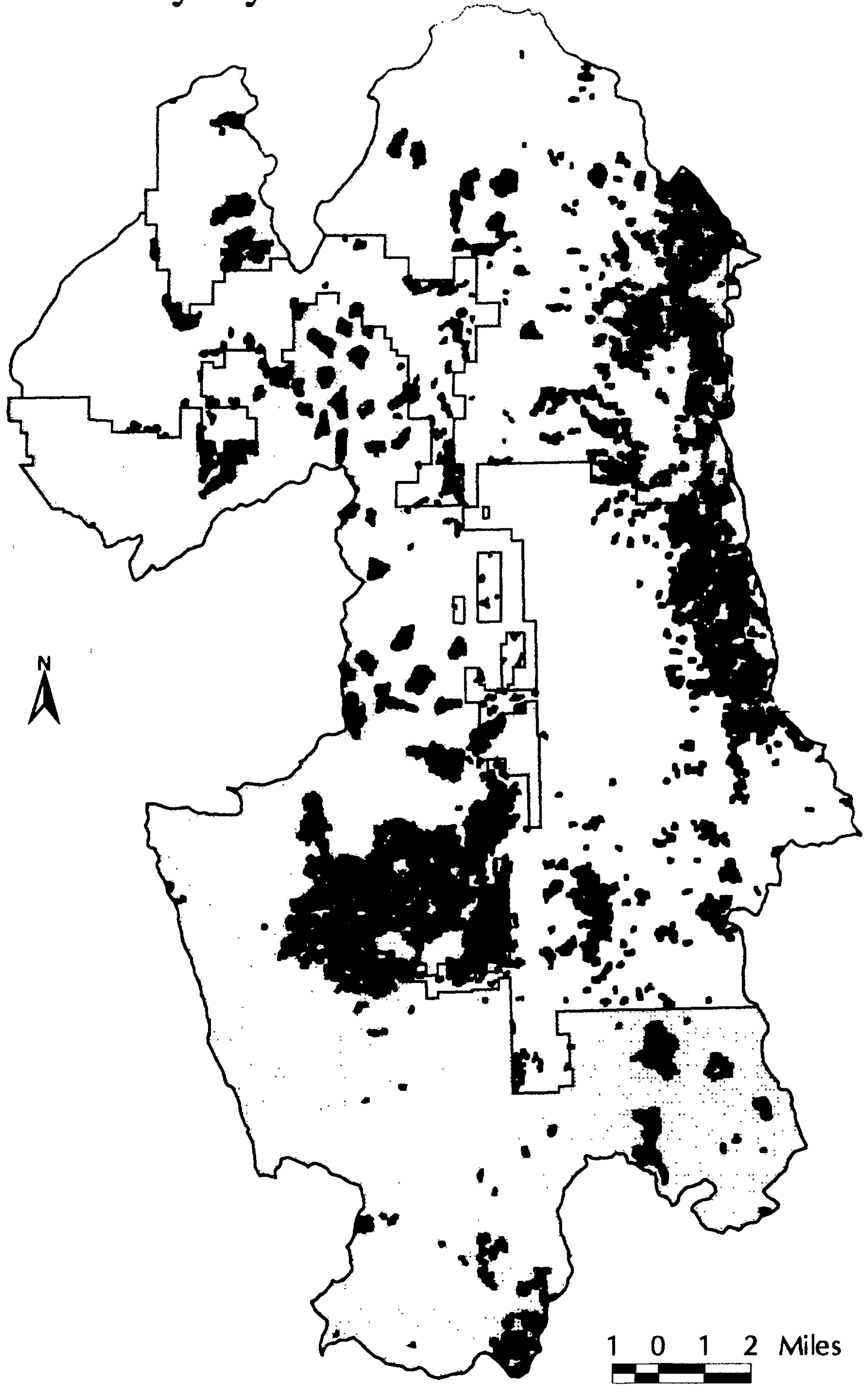
Primary Deer Fawning Areas



Bitterbrush Forage



Early Successional Forage Created Primarily by Timber Harvest



Eagles

Eagles prefer very large (usually 30"+ dbh) conifers (generally ponderosa pine, but they will use large lodgepole) for nest trees. These nest trees are generally located within one mile of wet riparian areas (marshes, lakes, rivers) and on the higher slopes of buttes, ridges, mountains, etc. The winter population stays fairly close to perennial watered riparian areas that support both fish and birds.

Eagle nesting and use within the analysis area has remained fairly stable over the last ten to fifteen years (there are two confirmed active nests). There is some speculation that there may be an additional nest, but it has yet to be confirmed. Most management areas set aside by the Forest Plan have some eagle use occurring within them on an annual basis (See Appendix A, Management Areas, and the Bald Eagle and Goshawk Management Areas map on the following page).

Goshawks

Goshawks generally prefer fairly dense stands of mid to late seral lodgepole pine for nesting. They hunt in either open pine stands, snag areas, or adjacent riparian areas.

Presently there is no reliable baseline information available to determine the status of Goshawks within the analysis area. There have been some sightings, but surveys for this species are still in the early stages. The Forest has set aside numerous joint management areas for this species and the black-backed woodpecker.

Beaver

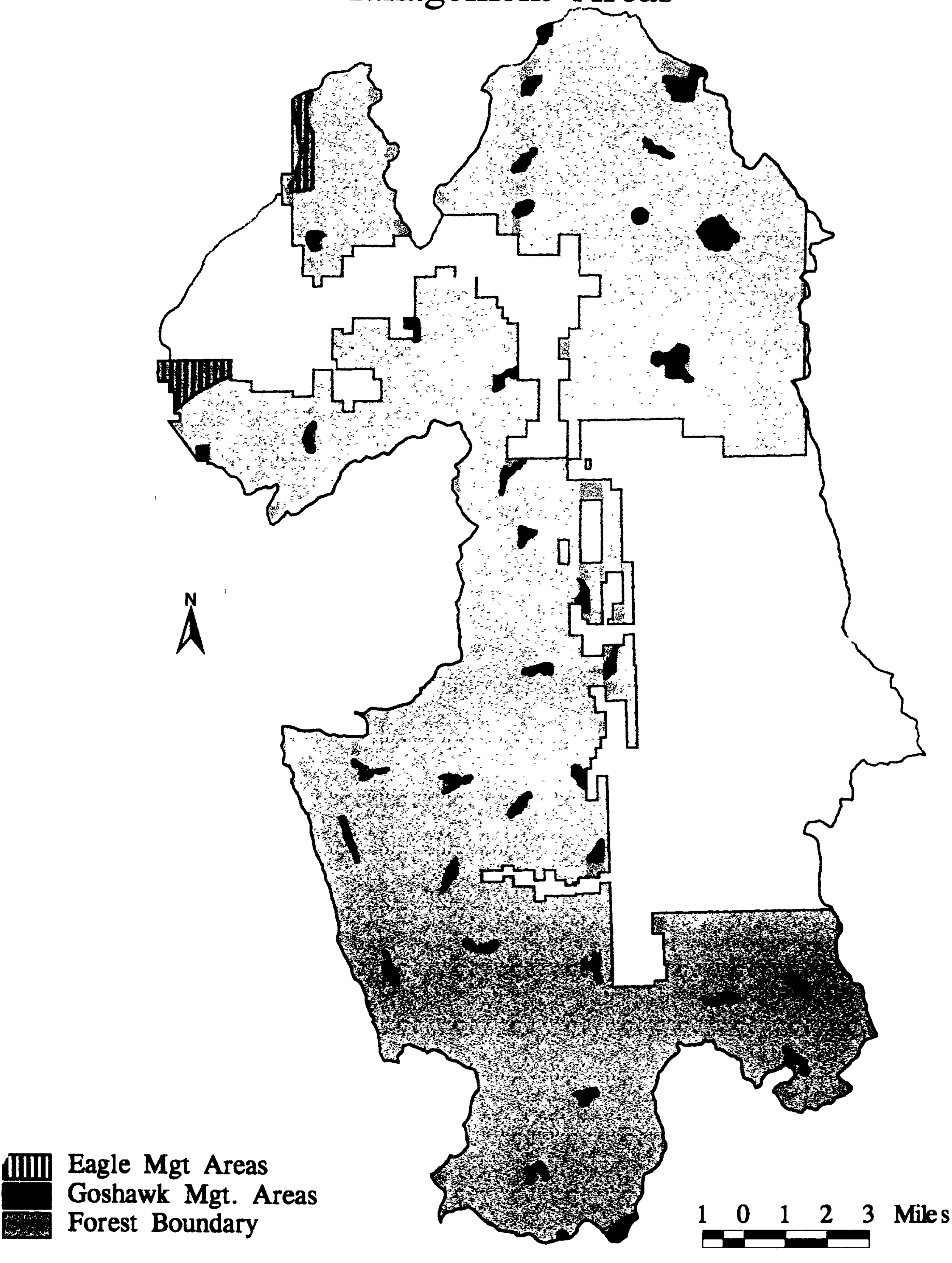
There are no known surveys for this species. Presently beaver are present in most perennial streams (Ex. Williamson River, Deep Creek, Jackson Creek). Their distribution and abundance is probably more restricted now than historically, since some water systems may have changed from perennial to short term intermittent due to man's activities. Also, essential hardwoods have been eradicated or reduced to the point where they are no longer capable of supporting beaver populations.

Beavers are found in small family groups along the entire length of the Williamson River. These residents usually den in the banks of the river (See Beaver Habitat map second page following). With the increase of willow growth in old oxbows on public lands along the Williamson River, it is felt that the existing populations may increase. Trapping beaver for pelts no longer has a significant effect on the population. Beaver presence in tributary creeks of the Williamson has not been well documented, and most if not all perennial systems have been diverted on private lands.

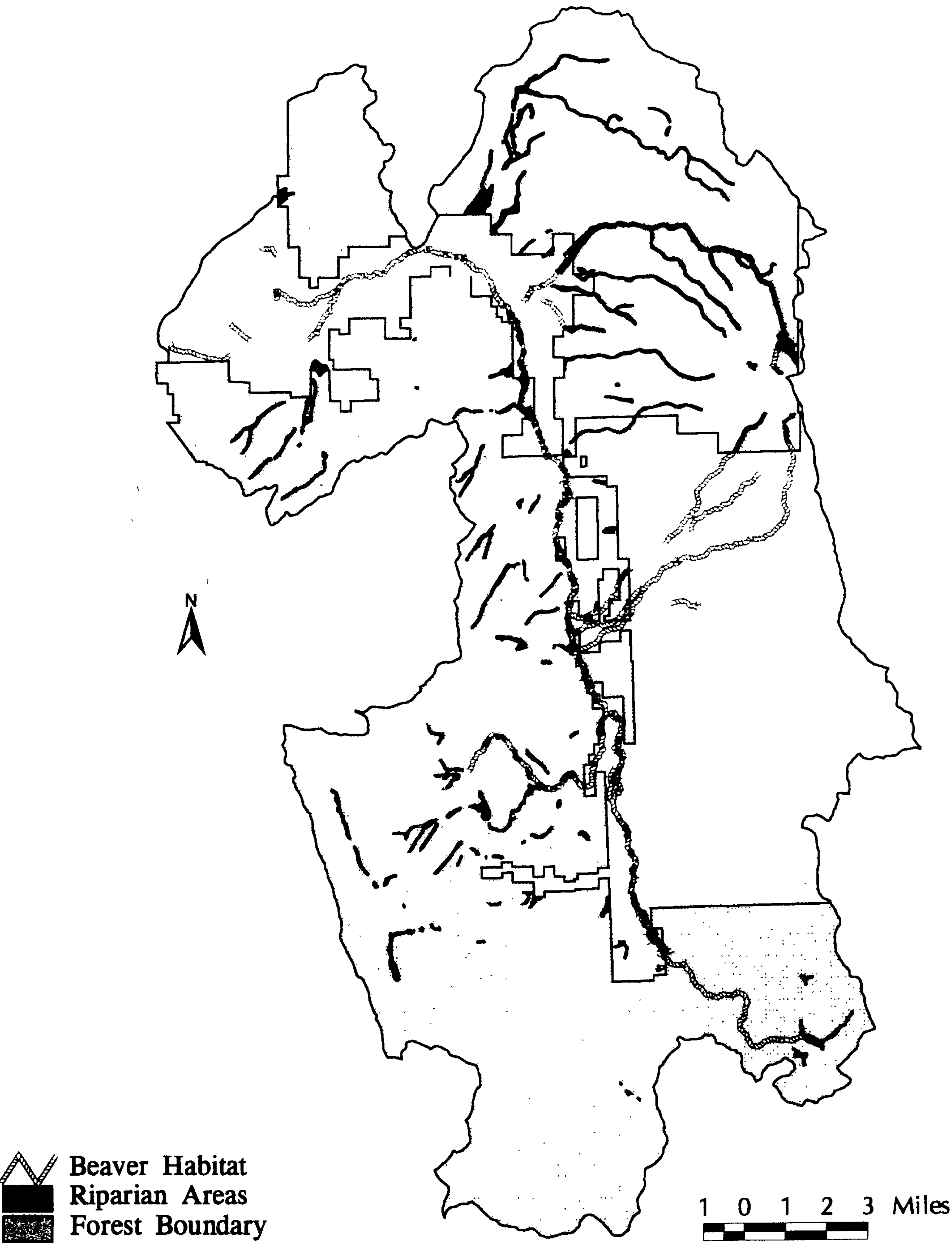
Trout

The primary fish of concern is the unique genetic stock of the redband form of rainbow trout that inhabit the upper Williamson River. These fish appear to fully stock the river from the Wickiup Springs area down to the Deep Creek and Aspen Creek confluence, a distance of roughly seven miles. The trout appear to use the river downstream of this point during the cooler water months only. Redbands have been reported to exist downstream through Klamath Marsh. It is assumed that the redbands in the marsh are of the same stock as those in the upper Williamson. Densities of trout

Bald Eagle and Goshawk Management Areas



Beaver Habitat



above the Deep Creek area are reported to be on the order of 2,000 fish per mile during the summer months. This number includes introduced brook trout. This density is extremely high even for a productive river. Summer densities below the Deep Creek area are less than ten percent of this. From Wickiup Springs upstream to the head of the river is dammed and diverted on private land. The Forest Service has very little information on this reach. Because of the dams, little exchange of fish is thought to occur with the rest of the river. Small numbers of redbands are reported in Deep Creek up to the Yamsi Camp area roughly 3.5 miles from the river (T31s, R11e, S21 NE/SE). No other tributaries currently have redbands in them. Jackson and Irving Creeks contain brook trout, but no redbands (See Salmonid Distribution map on next page).

The prime habitat is characterized by the trout's major survival needs; adequate hiding cover in proximity of sources of high quality forage and spawning habitat, in a temperature regime that is within the comfort range of the fish. The Wickiup Springs to Deep Creek reach fulfills these needs. Other reaches are lacking in one or several of these parameters which manifests itself in greatly reduced densities of trout. Explanations of these deficiencies will be covered in the next section.

The lack of a single habitat component does not necessarily deter fish from using a location, but when one component is lacking, others may be as well. The additive stress of multiple missing components does decrease the likelihood of habitat utilization. For example, the river water temperature below the Deep Creek area increases into the mid 70 F range during the summer, and aquatic vegetation and undercut banks are lacking as well. The lack of cover and forage habitat have combined with elevated temperatures to result in an environment that is less hospitable than above Deep Creek. With adequate cover and forage the trout may tolerate elevated temperatures, thus inhabiting this reach more extensively than at present.

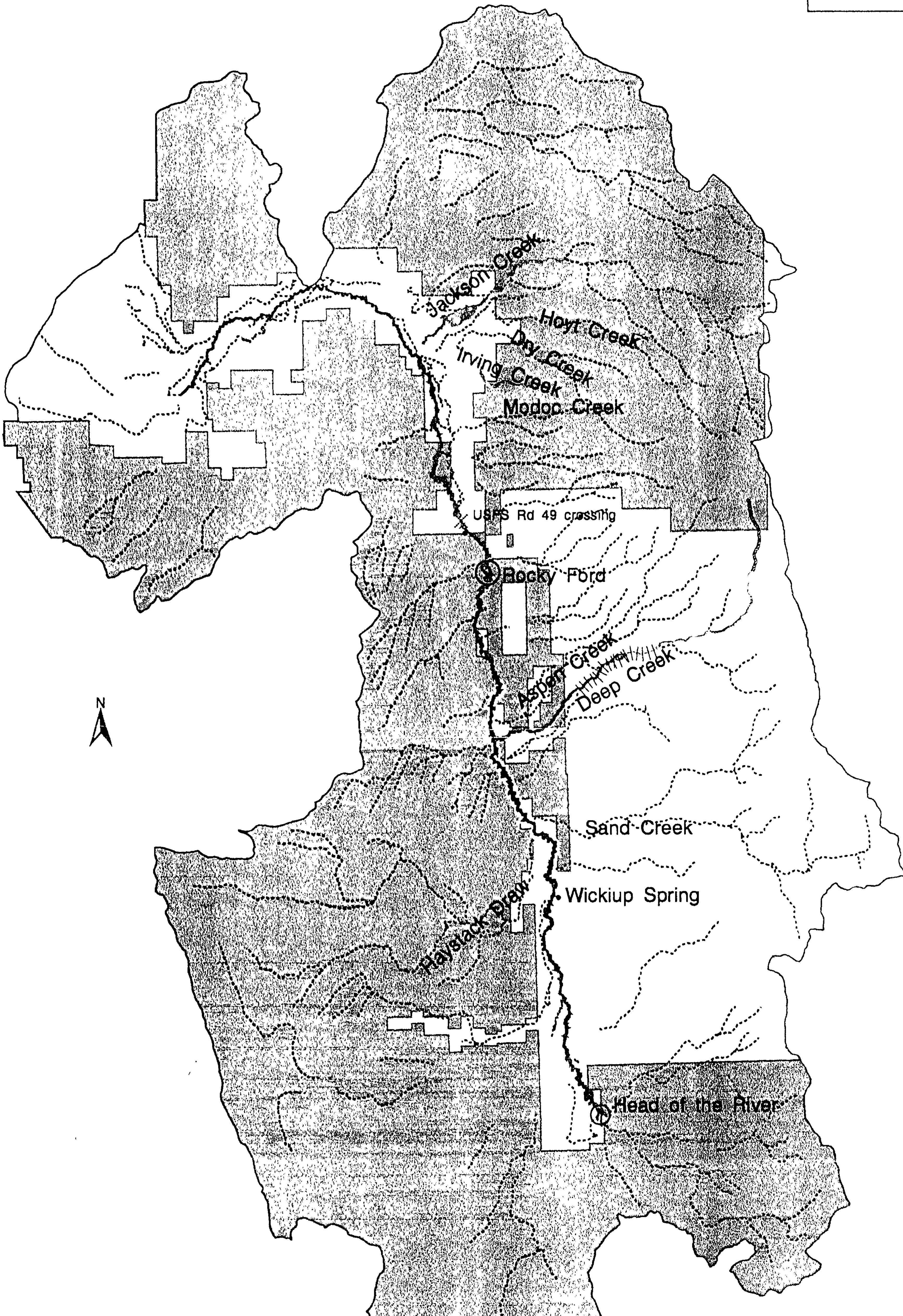
Bull trout

According to Dave Buchanan (ODFW, personal communication), Cope found Bull Trout in the Williamson River after finding them in Sevenmile Creek in 1879. He did not specify the upper or lower section of the river. Unsubstantiated evidence exists of bull trout in streams flowing into Klamath Marsh from the Cascades. If this is true, these streams were probably recolonized from refuge habitat in the upper Williamson drainage after the pyroclastic flows from Mt. Mazama destroyed their previous habitat. No direct evidence of bull trout in the upper Williamson exists, although suitable habitat does exist. If bull trout survived to the modern era, they were probably replaced by introduced brook trout stocked as early as the 1930's (USFS data).

Miller Lake Lamprey

Very little is currently known. Darryl Gowan (USFS, Fishery Biologist, personal communication) collected one adult lamprey from Deep Creek. A Crew from Oregon State University also collected several ammocoetes and one adult at Rocky Ford. Adults are required for positive ID. Dr. Doug Markel at O.S.U. inspected the sample from Rocky Ford and indicated it looked very much like a Miller Lake lamprey, but he needs more adult samples to be confident. Prior to collecting these specimens the Miller Lake lamprey was only known to inhabit Miller Lake. If this lamprey is the same species, then these are the only adults sampled since ODFW eradicated the lamprey from Miller Lake in 1964 (Salinas, 1985). Since they are thought to be extinct, very little is known of their life history

Salmonid Distribution



Brook Trout/possible Redband & Rainbow Trout
Redband/Rainbow/Brook Trout
Possible Brook Trout
Brook Trout only
Prime summer refuge habitat
Non-fish bearing
Forest Boundary

Created 6/5/96, Beth Williams

1 0 1 2 Miles

and range. Dr. Markel indicated that Miller Lake lamprey are the smallest parasitic lamprey known The O.S.U. crew that sampled the adult from Rocky Ford also found three inch long dace with parasitic lamprey scars on them. This is further evidence of the possible existence of Miller Lake lamprey.

<u>Due to the lack of information on Bull trout and Miller Lake Lampreys, they will not be discussed further.</u>

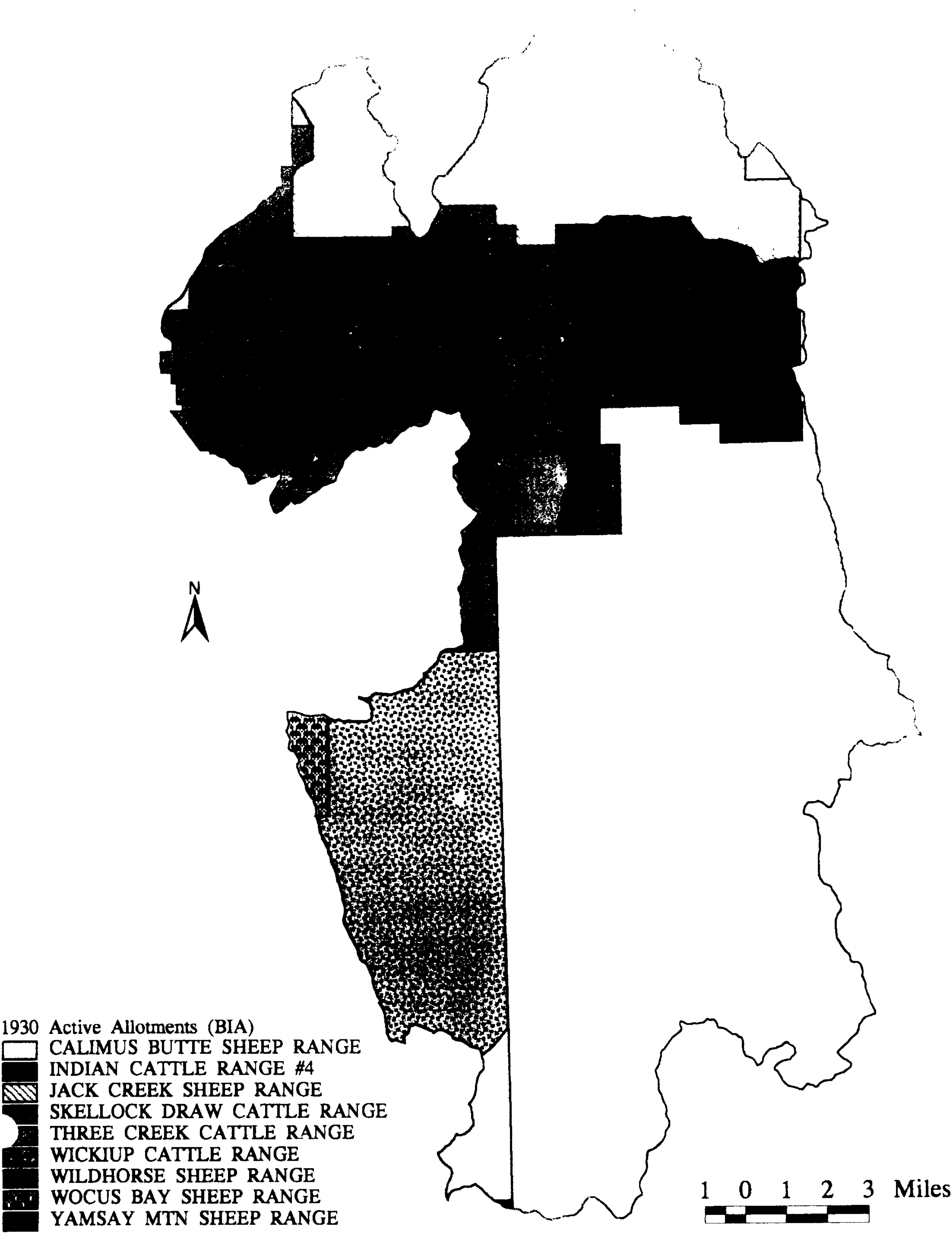
Step 2: What are the current habitat conditions and trends for the species of concern?

Elk

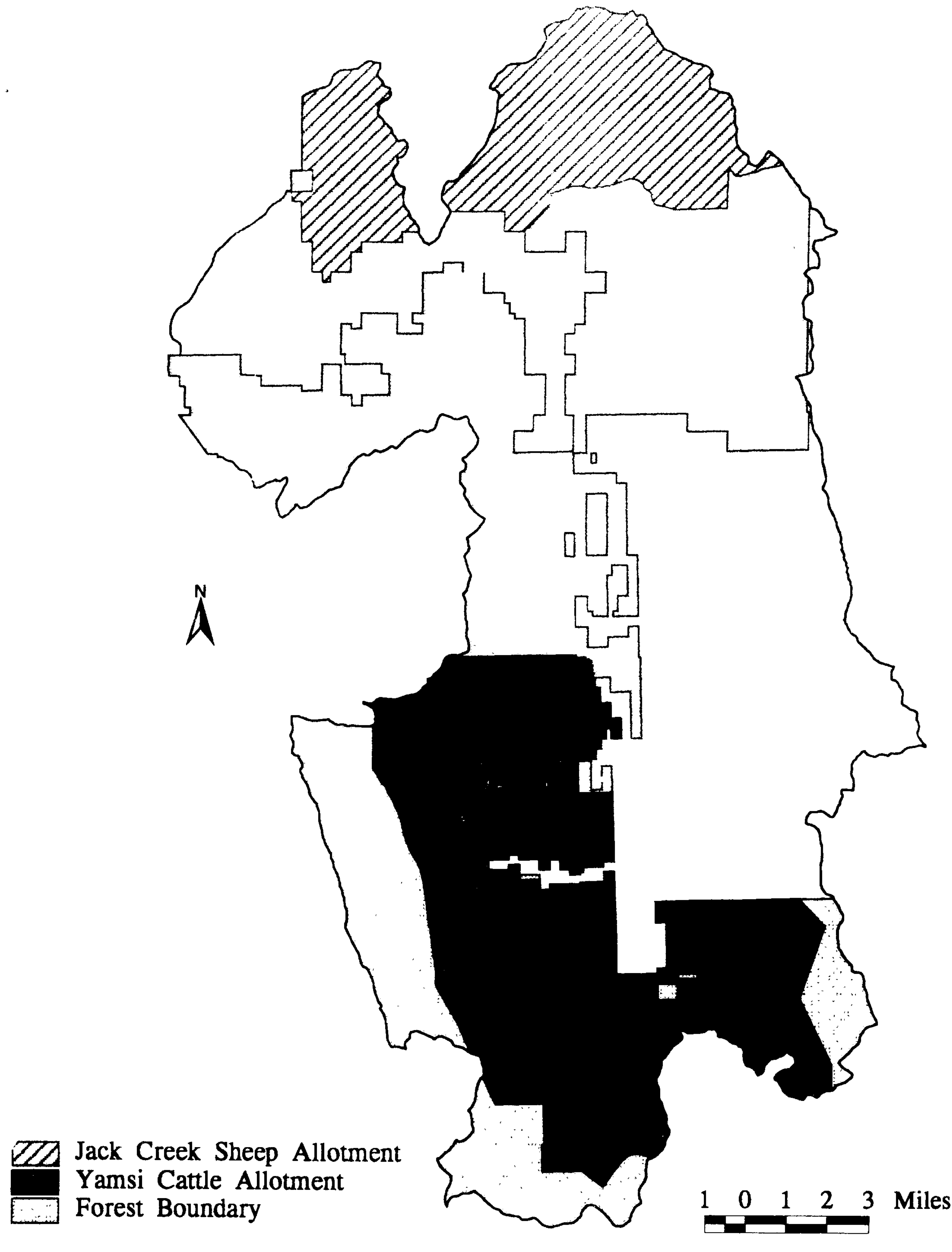
Elk population increases within the analysis area are in a large part due to the extensive removal of timber during the late 1970's through the 1980's on both private and public lands. This allowed early successional forage to increase (primarily dryland grasses). Further population increases may be related to decreases in livestock numbers, grazing intensity, and acres grazed on both public and private lands (See maps showing Historic Active BIA Allotments and Current Active FS Allotments on next pages). Some of the early successional forage areas created in the 1970's and early 1980's, are now converting more to a cover type than a forage type. Livestock use has decreased allowing elk use of meadows to increase. Some forage production in meadows may be lost due to conifer encroachment. Also, some of the early successional forage areas created in the 1970's and early 1980's, are now converting more to a cover type than a forage type community.

Photo showing a common occurrence within the analysis area; conifer encroachment into a meadow type community.

Active BIA Allotments - 1930



Current Active Range Allotments



The analysis area provides important calving areas for elk (riparian areas w/associated cover of either conifers and/or hardwoods). Elk are probably playing a bigger role in interspecific competition with mule deer use of the analysis area than is currently being realized. There have been no attempts to document this, and no studies have been designed to determine the extent that competition is occurring between deer and elk. The ODFW has recently established management objectives for elk in south central Oregon. The Winema National Forest has not made an active attempt to manage for elk east of US Highway 97, other than partially funding a joint elk population study with ODFW and the Oregon Hunter's Association.

It is felt by several biologists that elk are still increasing, and have not reached the carrying capacity of the habitat. One of the main factors limiting elk increases within the analysis area is road densities of 3.8 to 4 miles of road per square mile.

Mule Deer

Mule deer populations started to decline after a major growth period during the 1950's and early 1960's. This trend occurred across most western states. As mule deer declined in numbers, elk started expanding in both numbers and area used.

Mule deer require a diverse array of plant species for forage (Wallmo, 81). Mule deer intake of a specific forage plant, or group of plants, is tied to the availability and seasonal palatability of the species. Numerous authors have demonstrated the importance of succulent forbs to mule deer during spring and early summer, a period of high energy demand for does and fawns (Julander et al, 61; Salwasser, 76; Thomas et al, 79; Leckenby et al, 82). Stuth and Winward (1977) demonstrated the importance of herbaceous meadow plants on the early summer diet of mule deer on the Chemult Ranger District. Salwasser (1977) linked the dramatic decline of the neighboring Interstate mule deer herd to the reduced availability of succulent spring and early summer forage, and pointed out that the decline in succulent plant availability was a direct result of the cessation of one or more disturbance factors. Preliminary results from a recent cooperative study by Peake shows a very strong correlation between the decline of the forage base and the decline of mule deer numbers in the greater Klamath and Lake County areas.

Eagles

Presently there are sufficient nest and replacement nest trees adjacent to large riparian areas to accommodate the current population, including the possible new nesting pair. Conditions of marshy areas and the Williamson River are generally improving, and should continue to provide adequate habitat for prey species.

Goshawks

There are generally sufficient areas meeting the nesting requirements for Goshawks (closed canopies of mid to late seral lodgepole pine) within the analysis area. There is an increase in snags due to the extended drought conditions that occurred between 1987 and 1994. Riparian areas are also improving.

Until better baseline data is established, actual use of habitat areas cannot be determined. Trends for nesting habitat, unless a major fire occurs, appear to be improving due to increased stand densities and encroachment of lodgepole pine into riparian zones. However, this is being offset by increased firewood harvesting of dead lodgepole pine (prey base food source).

There have also been recent management activities designed to improve habitat for this species. Designating goshawk management areas, restricting management activities near active nests (distance and season), reducing general volumes of timber harvesting, reducing road construction activities, and providing additional snag areas which are important habitats for goshawk prey (woodpeckers), have all had positive effects.

However, as with the bald eagle, there continue to be management activities that pose threats to goshawks. Failure to close roads near or in goshawk nesting areas potentially allows more disturbance to occur during critical nesting periods. Fire suppression puts more mid and late seral conifer stands in jeopardy, which may potentially reduce both nesting and foraging habitat.

Beaver

Habitat conditions appear to be improving on public lands and on some private lands due to the reduction of livestock use near perennial waters. In some areas willows are reestablishing (ex. old Rocky Ford Area on the Williamson River).

Trout

Trout habitat is broken down into the following functional groups: spawning, refuge and cover, and forage habitat. (See Appendix E for a brief history of habitat improvement projects completed.)

Spawning Habitat

Spawning habitat is limited to several discrete sections of the river, and probably a couple of small sites on Deep Creek. The main spawning area on the river is at the mouth of Haystack Draw. Ancillary spawning occurs at the mouth of Deep Creek and near Rocky Ford. Recruitment appears sufficient to fully stock all of the habitat that is functional during the summer critical period of high temperatures. Thus, spawning habitat is currently sufficient. Stability of spawning habitat is not known, but it has survived significant human impact of the watershed, so it is somewhat resilient.

Because the river channel is dominated by silt and pumice sand, redband trout spawning habitat appears to be a very small portion of the riverine aquatic habitat. During wet climate cycles, spawning habitat potentially becomes limiting, as rearing habitat volume increases. Winema fish notes indicate a few redband trout spawning redds observed in the upper Williamson between river mile 74 and 75. The mouth of Deep Creek is at RM 74. Roger Smith, District Biologist from Oregon Department of Fish and Wildlife, indicated there is a small amount of spawning habitat at Rocky Ford and at Wickiup Springs. According to Steve Koon, manager for Sand Creek Ranch, there is spawning habitat from the mouth of Haystack Draw downstream to the mouth of Sand Creek T32S R11E S8 NW/NW. This 1500 foot reach represents the largest single concentration of spawning habitat on the river. The river flows over a reef at this point, thus increasing speed and scouring spawning gravels. According to Mr. Koon spawning occurs in this reach from mid January into March, with a peak in mid February.

Photographs from a 1995 USFS survey of Deep Creek indicate the existence of spawning habitat although it may be underutilized at this time. Redband trout (estimated length 150-180mm) have been observed here by Darryl Gowan, (USFS, Fishery Biologist, personal communication). Deep Creek is the only tributary that has a perennial aquatic connection to the river at this time. During climate cycles that are sufficiently wet for the marsh to contribute increased forage habitat, Deep Creek may be very important as a supplement to the river's spawning habitat. Jackson Creek would most likely be a primary spawning area as well if it were still connected to the river as it was during the reference era. During wet climate cycles Sand Creek may possibly be perennial for several consecutive years and be able to provide additional spawning habitat. As rearing habitat increases during wet cycles, secondary spawning habitat logically becomes increasingly utilized. Even though these areas may be presently marginally utilized, they likely will be important during wet climate cycles in the future, when larger areas of habitat are available within Klamath Marsh.

Plumie Wright, a long term resident of the analysis area, indicates that rainbow and brook trout used to over-summer and spawn in springs near the Kittridge ranch, T30S R10E. It is not known if this area is utilized for these purposes today. A review of USGS quadrangle maps indicates a potential for some of these springs to be hydrologically associated with tributary watersheds that either have no surface channel, or exhibit intermittent surface runoff. One local example is Jack Creek as it approaches the Kittridge ranch. Aerial photographs indicate a short tributary of the river that aligns with Jack Creek. If this possible spring is traditional over-summering or spawning habitat, then the Jack Creek watershed provides a critical benefit to the fishery, in addition to supporting the Klamath Marsh and upper Williamson aquifer. Aerial photos also indicate possible springs at the mouths of Sand Creek and Haystack Draw. These sites should be investigated for the possible existence of critical aquatic habitat, because of the cool water refuge and potential spawning habitat they may contribute to the watershed.

It is possible there are numerous unidentified springs that provide critical habitat to the Williamson. They would not be apparent on aerial photos. A high resolution thermal infrared GPS linked aerial video series may be able to identify these features. This technology supposedly has the ability to determine temperature to a 1.5 foot square area. This resolution should be sufficient to locate every significant spring associated with the river.

Summer Refuge Habitat

Refuge and cover habitat seems critically limiting during the summer. Spot inspections upstream of the reef where Haystack Draw joins the river (RM 77.5), indicate ample amounts of undercut banks and aquatic plants for use as cover. The river exhibits little if any incision here, and appears to have access to its floodplain. Downstream of this area the river becomes increasingly incised; bank undercut failures increase, temperatures rise, and aquatic plants become sparse. This combination of lack of cover and increased temperatures degrades refuge habitat quality below the threshold of functionality. Somewhere, probably below Deep Creek, trout densities drop precipitously during the summer, rendering the lower river marginally productive for trout. Refuge habitat is increasing because of modifications in land use practices, particularly the exclusion of livestock from riparian areas.

Since the source of much of the river's flow is groundwater, flood events and freezing are probably not critical habitat limitations. Thermographs from Rocky Ford indicate very infrequent freezing water temperatures. Summer refuge habitat is most likely the current limiting factor for trout on this river. High quality summer habitat has most likely decreased in size since the reference era due to the additive stressor effects of degraded water quality (temperature and sediment increases), habitat quality (less hiding cover) and less water flow. A 1979 ODFW survey of the river indicated a 2 degree centigrade temperature decline on the reach where Aspen and Deep Creek join the river, as compared to the adjacent downstream reach. Daily afternoon temperatures dropped from approximately 17 to 14.5 centigrade. However, this temperature regime lies within the comfort range of rainbow trout, and considered singly, is probably not a significant enough stressor to discourage trout from utilizing the habitat. The same survey also noted an increase in water clarity, the occurrence of submerged macrophytes, and increased fish sightings in the same area. It may be that cover and forage production provided by macrophytes resulted in improved habitat productivity. Visibility may have also simply allowed greater opportunity for observation. This area should be sampled for fish during a warm water period to determine any differential in fish population density and to attribute any difference to lower temperatures or improved cover and forage.

Forage Habitat

Summer forage habitat experiences the same limitations as refuge habitat. It may extend further downstream, since fish tend to utilize forage habitat adjacent to refuge habitat, especially when refugia becomes over-crowded. During the cooler seasons these fish may range much further downstream in order to take advantage of habitat that went underutilized during the summer. The degraded channel areas appear to be very simple habitat, without features such as aquatic macrophytes that increase surface area for forage production. Unstable sediments common in the lower reaches are likely also marginal forage producers. Considering these conditions, the high quality forage habitat probably is contained in the approximately seven miles of river from Wickiup Springs down to below the Deep Creek reach. The roughly eighteen miles of river below Deep Creek to Klamath Marsh is characterized as marginal forage habitat due to its lack of productivity and inhospitable summer conditions. Forage habitat within Klamath Marsh can largely be classified as nonfunctional, not because of the environment itself, but because access from the upper Williamson has been severely degraded by irrigation diversions. It is very difficult to quantify the marsh, as its size fluctuates so much due to climatic cycles. If trout have access to the marsh, there would be a significant increase in habitat size. Forage habitat may be static to somewhat increasing due to land use improvements. A good connection to the marsh might provide a quantum increase in available habitat. As summer forage habitat increases, there should be less crowding in the existing high quality habitat. This should produce more large fish as the per capita forage base increases.

Rainbow trout have been captured in Klamath Marsh, particularly at the Military Crossing Road and from Silver Lake Highway down to Soloman Flat, from spring through early summer, at least through the mid 1970's (Clinton Basie, personal communication) (Rod Johnson, USFS, personal communication). It is assumed these are upper Williamson stock that have traveled downstream during favorable environmental conditions, to take advantage of abundant forage in the marsh that they cannot access during very warm or low water periods. This adfluvial behavior results in greater fishery productivity in the system by resting the upper river forage while utilizing the large forage base of the marsh.

Access to the marsh, and a network of well defined channels in the marsh from which to forage, are necessary for fish to utilize the forage base here. Irrigation diversions and channel modifications may interrupt the natural system of channels that provide upper Williamson fish access to habitat from the marsh downstream to the Soloman Flat area. Analysis of local topography and historical maps indicates the Williamson River originally entered the marsh south of the peninsula area that splits the marsh at T30S, R9E, S14-16. The river probably then flooded and focused its energy on the southern half of the marsh, which is the area south of the peninsula. The marsh north of the peninsula apparently was not as wet and was mainly supplied with water from drainages to the north (Government Land Office Map, 1892, held at USFS Winema Headquarters). More recently, most of the river has been diverted through a canal to the north, which splits from the natural river channel at the headquarters for the Klamath Forest National Wildlife Refuge at T30S, R10E, S18. This diversion currently floods a large area of the north end of the marsh for waterfowl habitat. This rerouting may adversely affect the aquatic connection of the upper Williamson with the natural deeper water habitat in the southern area of the marsh. Existing channels suffer from being drier, which allows invading vegetation to trap silt and block the channels.

Beaver most likely played an important role in channel maintenance and development in the southern half of the marsh, because the deeper water would provide a more perennial type of aquatic habitat. It is also their habit to develop numerous side channels in order to safely access food supplies (Olson and Hubert, 1994). These side channels produce forage for trout. The diversion of the Williamson River water to the north end of the marsh likely has a negative effect on beaver habitat, since a lack of surface water discourages colonization by beaver in the southern half of the marsh.

Lowering the water table of the marsh by ditching, and the possible 1908 lowering of the reef at Kirk (unsubstantiated local history), directly reduced the volume of habitat in the marsh. However, field inspection of the hydraulic control point at Kirk indicates a relatively minor impact. Climatic fluctuation probably has by far the largest impact on habitat. Leonard and Harris (1974) documented long-term groundwater elevation fluctuations of up to twenty feet in Klamath Marsh during the twentieth century. A lowered water table also has some effect on the majority of the river channel, since the average slope of the river valley from Wickiup Springs down to Soloman Flats is 0.02%. During wet climate cycles this low stream gradient may cause the upper Williamson valley to function in a similar manner to Klamath Marsh. Some of the long term area residents claim the river valley was historically softer and spongier, even during the dry season. Besides providing more habitat, a high water table also moderates stream temperatures during summer and winter.

Habitat Cover Components

Aquatic Macrophytes

Presently, submerged aquatic macrophytes significantly add to cover and forage production (both autotrophic and heterotrophic) substrata in the upper Williamson River. By adding structure to the areas of open channel, they provide habitat for invertebrates, substrate for algae to grow on, and become forage themselves. They also reduce sediment load by stabilizing stream substrata and directing flow into narrower channels around stands of plants. Fish utilize the edges of plant stands for cover.

Persistence of aquatic macrophytes in the river suggests their presence during the reference era. Increased siltation and a decline in water clarity due to channel damage since the reference era, have created a more hostile environment for aquatic macrophytes. A 1979 survey performed for ODFW documents aquatic macrophytes at river mile 73, and notes increased water clarity at the same point. Photographs upstream of this point also show reduced bank erosion. Additionally, the survey notes a drop in stream temperatures from approximately 63F to 58-59F in the same section. Darryl Gowan (USFS, personal communication) has observed only sporadic distribution of aquatic macrophytes downstream of Rocky Ford. Densities in the Sand Creek Ranch area are described as choking the channel (Steve Koon, personal communication).

Currently, nitrogen is limiting autotrophic (plant) production in the river (see water quality section). Nitrogen is increasingly limiting downstream of the major springs, and may be a major limiter of plant production from the Rocky Ford area downstream. If the reference era river channel were more shaded, due to a narrower deeper channel with more overhanging banks and riparian vegetation, then limiting nutrients such as nitrogen would be more available for plant growth further downstream. Reference era submerged aquatic vegetation would then likely not be as dense upstream (closer to the springs) as the modern era, and probably ranged further down the river. Thus submerged vegetation was most likely more efficiently distributed to provide cover and forage production for aquatic fauna.

Several species of submerged aquatic plant fragments were collected at the USFS road 49 crossing at T31S R10E S1 during winter, including: common elodea, whitewater buttercup, and water purslane. Plant fragments collected at the Silver Lake Highway crossing at T30S R10E S18 included common elodea, northern milfoil and pond weed. Positive identification of aquatic plants, and mapping their distribution in the upper Williamson, would be beneficial to maintaining and improving the river's aquatic environment. Positive identification should be done during the summer, when whole plants are available along with flowers. Since the plant fragments collected were not rooted, little can be said of the distribution of the samples, except that they came from upstream.

Undercut Banks

In its pristine form, the pre-reference era river channel was most likely narrower and deeper than the modern condition, with nearly continuous undercut banks on the outside of each meander. These undercut banks provide primary fish hiding cover which is especially important during stressful warm water periods. Removal of riparian vegetation has weakened the banks causing them to calve off into the channel, thus eliminating fish hiding cover. Two of the largest contributors to the loss of bank stability and riparian vegetation include; long term droughts (which lower the water table, thus taking water away from the roots of vegetation), and overgrazing by livestock.

Riparian areas along the river on the Kittridge Ranch (T30S, R10E, S18) are presently thickly covered with willow. The original vegetation was also dominated by willow, according to Clinton Basie, manager for the Kittridge Ranch. The willows were removed because they posed problems for the ranchers. More recently willows were allowed to recolonize the area, and have done so very successfully, despite the presence of beaver. The extent of willow dominance in this area suggests extensive coverage over the rest of the Williamson valley.

Watershed Continuity

Maps from the late 1800's indicate marsh levels of Klamath Marsh several feet higher than modern elevations. While this difference seems minor, on a 0.02% slope a few feet might make the difference between a losing and a gaining final reach of some of the tributaries that do not currently connect to the river. Losing reaches are areas where streamflow seeps into the ground at a rate higher than the stream can provide. Gaining reaches maintain or gain water due to seepage from the aquifer to the surface channel. Remnant channels, indicated on aerial photos of the mouths of streams such as Modoc Creek, may have exhibited surface flow more frequently during periods when the Williamson River water table was higher. Well logs have documented long term groundwater fluctuations in Klamath Marsh as much as twenty feet during the twentieth century, with seasonal fluctuations of one to several feet (Leonard and Harris 1974).

Channel modifications, where the river enters Klamath Marsh, may adversely affect the opportunity for recolonization and genetic exchange with aquatic fauna from tributaries of the south end of the marsh, by deterioration of marsh habitat mentioned earlier. Several tributary streams with perennial reaches have had channels that connected to the river at least during spring runoff. These streams may have provided important spawning and juvenile rearing habitat that is now lacking.

For the most part, the tributary streams flowing west into the river off Yamsay Mountain and Booth Ridge have cut channels to parent basalt type material, developing quality spawning gravel. In contrast, the main stem of the river consists mainly of pumice and sediments, with limited spawning habitat. There are numerous natural reasons for a break in the connection of a stream from the river; most of which would have happened prior to European settlement of the area. Breaks since the reference era have generally been human caused. The most obvious would be water diversion for irrigation e.g.: Jackson, Irving, Aspen and Deep Creeks. Not as obvious would be the lowering of the water table via removal of hydraulic controls such as the Kirk reef, ditching swampy areas to dry out pastures, grazing riparian areas which encourages channel incision, and removing riparian vegetation which maintained channels.

Specific Tributary Streams

JACKSON CREEK

Jackson Creek is potentially the largest tributary stream of the upper Williamson River, but the stream is totally diverted before it joins the river. It is not currently known how and where its water now rejoins the river. Instead of joining the river as one surface channel that would provide significant benefit to the aquatic biota of the river, water from Jackson Creek likely joins the river as groundwater over an extended area.

Jackson Creek has a significant potential as historic bull trout habitat, and as a primary area for spawning redbands. According to Plumie Wright, the confluence area with the river traditionally held adult redband trout during the summer. Currently, brook trout inhabit the lower 4 miles of Jackson Creek. The creek was electrofished from 1990-92 by the Klamath tribe, ODFW, and USFS. Only brook trout were found. USFS notes indicate brook trout were stocked in 1931, and rainbow trout in 1947.

Since redband trout have been found in Deep Creek (see below), it is logical there were redbands in Jackson Creek when it had a connection to the river. The life history of Jackson Creek stock could have been either adfluvial, fluvial, or headwater in nature. The larger size of Jackson Creek would tend to provide spawning substrate for larger adfluvial forms of trout instead of headwater stocks. Since brook trout appear to be the only remaining fish in Jackson Creek, they may have a competitive advantage over any redbands stranded there that had either the adfluvial or fluvial strategy of life history.

IRVING CREEK
This creek is also diverted above the river. USFS data indicates flow rates of 1-2 cubic feet per second. This small spring fed system would provide cool water refuge to the river and possibly some limited spawning habitat due to its small size.

HOYT CREEK
Intermittent. No perennial habitat.

DRY CREEK
Intermittent. No perennial habitat.

MODOC CREEK
Modoc Creek shows up as a vestigial channel across the valley bottom to the river. There is a possibility of an aquatic connection to the river during wetter climate cycles. The perennial reach flows approximately 1-2 cfs currently. Modoc Creek would probably function similar to Irving Creek when connected to the river, except that the vast majority of the stream has a gradient greater than five percent, which would be considered too steep for trout to inhabit without assistance such as beaver ponding.

SHEEP CREEK
This stream has a perennial stretch but no channel close to the river. Its gradient is also mostly greater than five percent. Its value as fish habitat is probably more of a supporting role for the aquifer.

ASPEN CREEK
1979 ODFW survey notes indicate cooler river temperatures just downstream of Aspen Creek. This may indicate subterrainial flow from Aspen Creek into the river. Aspen Creek appears to be diverted into a series of irrigation ditches that eventually join Deep Creek. It is doubtful that fish passage is possible. Most of Aspen Creek lies on private land. Habitat on Forest Service land should be surveyed, and the presence of lamprey or other fish investigated. Aspen Creek is mysteriously small for the size of its watershed, which is of a similar magnitude as Deep Creek. Surface flow appears to be less than ten percent of Deep Creek. There may be some geological explanation for this. Currently Aspen Creek appears too small, even upstream of diversions, to offer fish habitat.

DEEP CREEK
This is the only tributary perennially connected to the river. Sediment transport to its alluvial fan may risk the perennial aquatic connection to the river. The consequences to sensitive species such as the Miller Lake lamprey, of cutting this tributary off from the river are unknown, but potentially very significant. Weyerhaeuser biologists electrofished Deep Creek during the fall of 1995, finding an

abundance of brook trout and some redband trout up to at least Yamsi Camp at NE/SE S21. Darryl Gowan (USFS, personal communication) observed several redband trout of 150-180mm in length near the FS road 4648 crossing.

A 1995 level II stream survey indicates channel incision on USFS land at T31S, R11E, S31 SW/NW. Photographs accompanying the survey indicate a Rosgen "C" type channel with a wide, shallow wetted channel that potentially could pose passage problems to spawning runs of fish. This survey was not conducted on adjacent private property in sections 31 and 32. Because of the importance of the private reach at the lower end of the stream, it should be resurveyed, if permission can be obtained from the owners of Deep Creek Ranch.

It is possible the redband trout observed in Deep Creek were juveniles escaping predation and competition from larger fish in the river. They may also be seeking cooler water that Deep Creek offers. Larger fish could be space and forage limited in Deep Creek. Rainbow trout spawn in the river upstream of Sand Creek from mid January into March. A spawning ground survey of Deep Creek during this period would reveal if Deep Creek is utilized for spawning, and whether the fish are a headwater (live in Deep Creek throughout their lives) or adfluvial (spawn in Deep Creek but live in the river the rest of the time) form. Outmigrant traps would also indicate spawning. Survey photos indicate potential quality spawning habitat in T31S, R11E, S29 SW1/4. If barriers to spawning runs are discovered, they should be modified to provide passage, if the fish are adfluvial. If redbands were precluded from spawning habitat by modifiable barriers, then brook trout, which were introduced during the early 1930's, should be eradicated in order to eliminate potential interspecific competition, and maximize the effectiveness of spawning and early rearing habitat provided by Deep Creek. This would not eliminate brook trout from the upper Williamson river, but would give the redbands a head start in Deep Creek.

If spawning does occur in Deep Creek, these fish are potentially reproductively isolated from the redbands that spawn in the Williamson River. It is possible the Deep Creek redbands represent a headwater stock, or a reproductively isolated adfluvial form that is genetically distinct from the redbands that spawn in the river. Unique genetic traits might be identified via electrophoretic or meristic differentiation. It is not known where the upper Williamson redbands sampled by Buchanan (1994) spawn, but future samples of juveniles from Deep Creek could be compared to samples from the river for genetic differences.

Deep Creek enters the river as two channels. The main channel enters the river at the northwest corner of section 31. Both channels appear to be natural, but the south channel is apparently a constructed diversion ditch (Darryl Gowan, USFS, personal communication). A cooperative investigation should be conducted with the owners of the Deep Creek Ranch to study possible consolidation of these channels. This would be provided that the combined channels might enhance redband spawning and rearing habitat in the upper Williamson watershed by increasing summer flow and habitat volume in the main creek channel and lowering stream temperature.

SAND CREEK

0.4 miles of Sand Creek lies on Forest Service property, starting 0.6 miles east of the channel's confluence with the river. Considering the five foot diameter culvert at the 4648 road crossing, it seems likely there is an aquatic connection to the river during storm events or spring runoff.

Weyerhaeuser biologists surveyed several points along Sand Creek from mid October to early November of 1995. They reported no perennial reaches, and no standing water was observed. Mike McNeil, USFS (personal communication), observed flow into mid September of 1995 on some higher reaches. 1992 through 1994 water flow information from the USGS gauge at the FS 49 road/Williamson River crossing, indicates the possibility that Sand Creek is functionally a perennial system, in particular reaches, during periods of above average precipitation. Flow rates for June through August 1992-94 were 68, 91 and 70 percent of average over the past 21 years. Climatologists claim Oregon has also been in a twenty year dry cycle up to this point. According to Steve Koon, Sand Creek has been flowing to the river since December of 1995. If beaver inhabited the high meadow area around King's Cabin, then associated stream reaches would be more perennial in nature. It may be that Sand Creek is cyclically perennial, and it possibly could supply spawning and early rearing habitat to the upper Williamson system during wet climate cycles.

Mr. Koon has recently observed brook trout and possibly dace in Sand Creek. Therefore, it is accessible to the river, and may provide perennial habitat during the wetter years.

Sand Creek appears to be a flashy system with an abundance of cobbles and boulders. It may provide spawning substrate to the river at its confluence. Aerial photos indicate a potential spring at the mouth of the creek that may provide critical habitat, thus Sand Creek is important for the maintenance of possible springs, as well as providing what is probably a sizeable contribution to the upper Williamson aquifer.

The majority of the creek is a narrow canyon high gradient system (5%+) that is most likely inhospitable for beaver colonization (Olson and Hubert, 1994). The wider, low gradient, meadow system above the canyon section would probably support beaver, which could develop perennial reaches for fish refuge.

Monitoring channel and sediment stability of Sand Creek will benefit the Williamson River watershed by identifying problem areas such that mass sediment transport can be minimized, while maintaining recruitment of spawning gravel to the river.

WICKIUP SPRING

Aerial photo analysis indicates Wickiup Springs as the primary source of water for the river downstream of the Yamsi Ranch. The photo indicates channel widening beginning approximately one river mile upstream of Wickiup in the NE/NW of section 20; which is approximately 500 feet upstream (south) of the 17/20 section line. The channel widens further at Wickiup. It is assumed that the channel condition is relatively homogeneous through this section, and the widening is due to groundwater contribution from Wickiup and several smaller springs, and irrigation returns from the Yamsi ranch. Wickiup supplies important spawning habitat, as well as the majority of the river's flow. This may indicate the functional upstream end of the summer habitat.

HEAD OF THE RIVER

The Head of the River Spring supplies water to the Yamsi Ranch reach, which is dammed and pretty well cut off from the lower river approximately 1.5 river miles upstream of Wickiup Springs. Brook trout and presumably some redband trout inhabit this reach. Very little information is available for this private reach. There may be little or no exchange of fish with the rest of the river. Numerous smaller springs exist along this reach.

Aerial photos indicate the dams on this reach have trapped a great deal of sediment, and have created large shallow ponds where water warms during the summer.

Step 3: What was the historical relative abundance and distribution of species of concern and the condition and distribution of their habitats in the watershed?

Elk and Deer

In his 1994 Elk Study, Foster notes that both elk and deer were present in eastern Klamath and western Lake County, at least since 1843 when Fremont made his second expedition through the area. Based on interviews of some local residents, during the 1920's and 1930's, elk and deer did not appear in large numbers within the analysis area. During the 1950's and 1960's mule deer numbers increased significantly, followed by a general decline to the present time. As stated previously, elk numbers were fairly low in the analysis area until the early 1980's, and they have been increasing since that time.

It is evident that the available screening in the ponderosa pine plant community was quite different prior to the broad scale suppression of periodic wildfire than what we are attempting to manage for today. Numerous authors have described pre-suppression ponderosa pine stands as open, "park-like", with limited understory regeneration (Lieberg, 99; Munger, 17; Franklin and Dyrness, 73). Cooper (1963) describes the ponderosa pine plant community in Arizona as an uneven aged forest composed of a mosaic of small (one-quarter acre or less), even aged stands. Understory conifers were far less prevalent and in much smaller patches than are represented under the present fire suppression regime. Large stands (greater than five acres) of even-aged conifers six to fifteen feet tall were rare, and occurred only following stand replacement events, which were also quite rare (Agee, 92). By our current definition (see Thomas, 79 and the ITAC mule deer model), hiding cover was virtually nonexistent in the ponderosa pine plant community and greatly reduced in the dry lodgepole associations.

Where was the hiding cover, if indeed any existed in the pre-suppression ponderosa pine forest? In the classic and much cited *Wildlife Habitats in Managed Rangelands-The Great Basin of Southeastern Oregon,* Leckenby et al (1982) describe optimum hiding cover as vegetation at least 24 inches tall and "...capable of hiding 90% of a *bedded* deer from view at 45 meters...". Though discontinuous and patchy, the pre-suppression pine forest provided cover in this form. Ecotonal moist lodgepole stringers or bottoms (such as Jackie's Thicket) fluctuated in stem density, often being thicket-like as a result of stand replacement outbreaks of insects, disease or periodic wildfires of various sizes. These sites were and are important cover areas for mule deer. Riparian corridors containing hardwoods and willows were extremely important for cover, forage and dispersal.

The shift in use from forbs to woody shrubs occurs in this area about mid July (Stuth and Winward, 77). Bitterbrush is the most important late summer and fall forage species for mule deer in the watershed, and by far the most common non-coniferous plant in upslope ponderosa pine and lodgepole habitats. Bitterbrush, under a fire return interval of 15 years, did not develop the robust 40" to 60" tall stature that is currently exhibited in this plant community, but instead was represented by low growth to about 30 inches. The robust shrub form requires a high degree of energy for maintenance. Under a short fire return interval, annual leader growth is concentrated, succulent and easily accessible to browsing mule deer. Herbaceous forbs and grasses were more abundant under the ponderosa pine overstory (Franklin and Dyrness, 73), allowing a broader seasonal use of upland ponderosa sites by mule deer.

Eagles

Historically, eagle populations were probably more significant along the upper Williamson and Upper Klamath Marsh until major road construction, ditching/diverting and draining occurred during the early 1900's, removing prey habitats. Also, the effects of pesticide use (DDT) for mosquito control, from the 1950's until its ban, probably affected eagles within the analysis area. Predator control using 1080 bait stations added to the problem, until also being banned.

Goshawks

Goshawks use a wide range of habitats. Historically, this species may have used more riparian hardwoods prior to active fire suppression. As conifer development and encroachment occurred in riparian zones, goshawks changed their nesting use areas. Smaller birds, such as woodpeckers, waterfowl, etc., make up a large portion of the goshawk diet. This species probably has always been present, but never in large numbers.

Beaver

Elizabeth Budy, Forest Archaeologist for the Winema, has stated that beaver were present when early explorers came through the Klamath Basin in the mid-1800's, although not in large numbers like they were in other parts of the west. This could mean that they were at the lower end of their population cycle, and most of the animals had moved on, since beaver populations are notoriously unstable. Beaver that were present were trapped heavily, as they were in other parts of the west.

Livestock were introduced into the area in the late 1800's, and their numbers increased and were sustained during this century. Competition increased between livestock and beavers for the existing willow communities associated with the perennial water sources in the analysis area. This reduced and/or removed the willow communities along these sources. Other agricultural practices that contributed to the decline of existing beaver habitat were: lowering the reef at Kirk; and dredging/ditching projects that were designed to improve pastures for domestic stock. The overall effects from these activities has been a general lowering of water tables in and outside the analysis area, changing some perennial streams to intermittent, or making them discontinuous in nature. Interviews with long-time residents of the analysis area indicate there has been no active attempt at removing willows from the riparian system, as has occurred in other areas.

Trout

Most of the river probably had high quality habitat, with more stable sediments and undercut banks supported by extensive stands of riparian vegetation. Summer refuge and forage habitat were much more extensive, providing a less stressful environment, with more forage per capita producing more and larger trout. Jackson and Irving creeks were perennially connected to the river, providing up to four or five miles of spawning and early rearing habitat. The river was better connected to the marsh, which provided several thousand acres of rearing habitat. Considering the additional available habitat, one might conservatively estimate a two to four fold increase in trout population, and at least that much in biomass. These additional fish would be distributed throughout the river all year, and in the marsh during the cooler seasons.

In order to describe the genetic stock of rainbow trout that inhabit the upper Williamson River and Klamath Marsh, a description of the environment in which these fish evolved is required, since the organism is defined by the environment it inhabits. Both the current and historical environment must be considered to understand the factors that shaped the present form of life.

According to Behnke (1992), redband trout invaded the Columbia Basin during the late Pleistocene (approximately 30,000 years ago), just before or during the last major glacial advance. The trout were most likely present in the Klamath Marsh drainage before the climactic eruption of Mt. Mazama (approximately 7,700 years ago). This is evidenced by the genetic difference from Upper Klamath Lake stocks, and that the two stocks do not appear to intermingle. Had Klamath Lake stock invaded the marsh after the Mazama eruption, then the upper Williamson stock would be genetically similar. According to Buchanan et al (1994), the closest relatives to upper Williamson stock reside upstream of Sycan Marsh and in Cold and Beaver Creeks, which are tributaries of Jenny Creek above a barrier waterfall.

Using well logs from Leonard and Harris (1974), isopachs (pumice depths) found in Williams (1942) and personal communication with Dave Sherrod, (USGS, Geologist) a reconstruction was developed of the bathymetry of the ancient lake from which Klamath Marsh evolved. Historical shorelines on the east side of the marsh along Wocus Bay indicate water levels up to twenty-six feet above the current marsh elevation. Williams (1942) indicates the occurrence of pyroclastic flows from Mt. Mazama across the marsh at Kirk. USGS quad maps indicate a possible pyroclastic dam there, to an elevation of 4600 feet. The current hydraulic control is at 4510 feet. Ash deposits on the west side of the marsh, at present surface elevations of 4520 feet, are on the order of 50 to 60 feet deep. From this information it was concluded that lake depths ranged from roughly 50 feet deep before the eruption, to possibly 80 to 90 feet just after the eruption. Since the pyroclastic material is fairly erodible, the post Mazama maximum depth probably eroded quickly down to denser material, thus the shorelines developing at twenty-six feet. The current control of the marsh is a basalt reef at Kirk, which is at the head of a canyon carved in basalt. It is assumed this was the approximate level of the hydraulic control before the eruption of Mt. Mazama.

Regardless of exact depths, a shallow broad lake bathymetry is indicated, with excellent solar exposure to the south. Thus far, information dating the historic shorelines has not been available, so the rate of lake to marsh evolution is not known. From this information it appears the redband trout of the upper Williamson River evolved with access to a large, shallow lake that was probably very biologically productive because of its shape, solar exposure and adequate supply of limiting nutrients, especially phosphorus. Considering the alluvial deposits that underlay the most recent Mazama pyroclastic deposition, the lake has probably been large and shallow for at least 10,000 years, and depending on the rate of alluvial deposition, possibly several times longer.

Considering this possible history, the marsh lake represented a very rich source of forage for fish. The most successful individuals would be able to take advantage of this forage base for the greatest length of time during the growing the season. Thus, it would be very advantageous for fish to tolerate warm water, in order to maximize genetic fitness by increasing body mass, which increases fecundity. This argument is further supported by the idea that the upper Williamson River had a narrower channel, with more overhanging banks and riparian vegetation than the modern river exhibits. Historically the river was more shaded, which limited biological productivity. Limited productivity in the river encouraged adfluvial behavior, in order to improve genetic fitness.

Organisms evolving in similar environments have a tendency to develop similar traits, regardless of their genetic relation. The Wood River stock of redband trout represent an intermediate form between the upper Williamson redbands and the Upper Klamath Lake redbands (Buchanan et al, 1994). Agency Lake is important foraging habitat for the Wood River stock. The lake currently averages only three feet deep, with a maximum depth of seven feet (Johnson et al, 1985). Since the surface elevation is the same as Upper Klamath Lake, the dam on Upper Klamath has some effect on the depth of Agency lake. The lake elevation has been raised by as much as three feet by the dam (Mike McNeil, USFS, Hydrologist, personal communication). Accounts from the early twentieth century describe Agency Lake as a marsh or prairie during dry climates (Elizabeth Budy, USFS, Archeologist, personal communication). This description creates an environment similar to a somewhat younger Klamath Marsh, which illustrates the impact of a lake environment on a river system. Wood River redband trout grow to a much larger size than would be expected if they spent their entire life history in the river. These fish also persist in the upper end of Agency Lake longer than the cool water season. It is expected that redband trout from the upper Williamson have the same tendency to utilize Klamath Marsh when sufficient water and channel development are available.

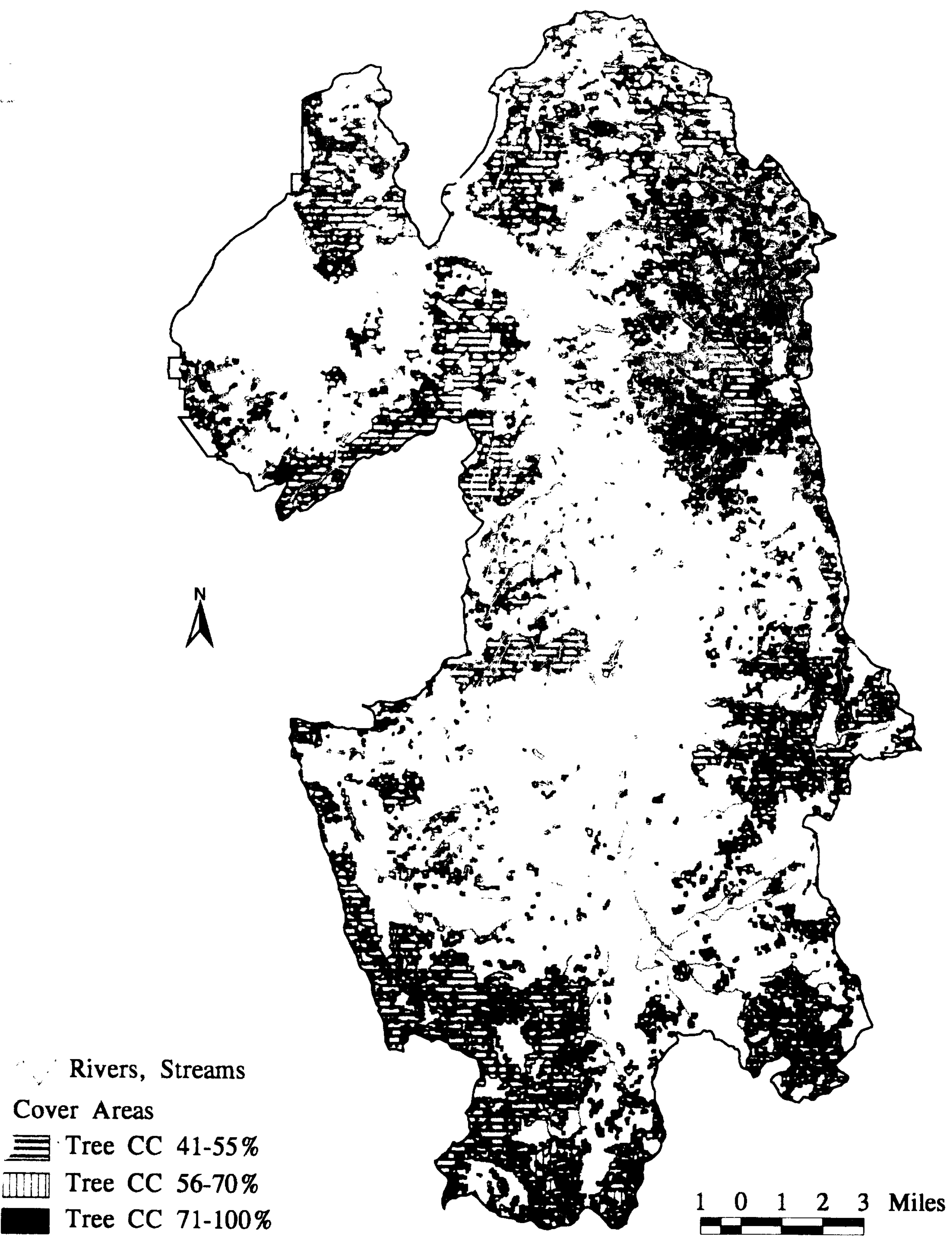
Redbands from Paradise Creek, in the upper Sycan River drainage, are closely related to the upper Williamson stock (Buchanan et al, 1994). In a 1992 USFS stream survey of Paradise Creek, redbands were observed to temperatures of 80 degrees F. Although Paradise Creek is much smaller than the Williamson, it still has spring fed headwaters for the fish to escape high temperatures.

Step 4: What are the natural and human causes of change between historical and current species distribution and habitat quality for species of concern in the watershed? What are the influences and relationships of species and their habitats with other ecosystem processes in the watershed?

Big Game

Probably one of the biggest natural factors in changing big game distribution is the succession of transitional and riparian forage bases to cover base (See Big Game Cover Areas map on next page). As canopy closure occurs and bitterbrush decreases in forage useability, less animal use results. Along

Big Game Cover Areas



with this, elk, being more mobile than deer, are more successful in capitalizing on both new transitional forage and existing riparian forage. Most riparian areas (meadows) are moving from an earlier successional stage towards some later stage, hence some of the succulent forbs necessary for lactating does are not present in the quantities that they were 25 or 30 years ago (especially public lands). Due partially to the drought years of 1987 to 1993, lodgepole encroachment into meadows has been replacing forage with cover.

The severe winters of 1989-1990 and 1992-1993 caused significant mortality to deer, and this has affected recruitment into existing populations within the analysis area. Major fire events outside the analysis area have resulted in a temporary loss of forage and cover on both summer and winter range. Elk were also affected by these winters and droughts, but to a lesser degree, due to their mobility and not having reached habitat carrying capacity.

Man's influences to big game habitat have both benefited and limited animals use of the habitat. Roads for example, increase disturbance and dewater riparian areas, but also provide early seral forage. Livestock grazing has maintained early-mid seral forage, but has also increased competition for existing forage, especially during extended drought cycles. Livestock are a source of introduced diseases (blue-tongue, bovine viral diarrhea, brucellosis, etc.). Predation on big game may be reduced by livestock becoming an alternate prey base, or by active predator control by livestock managers. Mid-summer through late fall grazing by livestock in hardwood riparian areas reduces and/or eliminates riparian hardwood cover and forage. Logging practices can reduce cover, increase forage, and increase potential disturbance of animals by increasing miles of roads.

Fire suppression has allowed development of forage base (bitterbrush), but reduced upland grasses and forbs. Presently, continued suppression has resulted in the decline of the forage base [lodgepole

Lodgepole encroachment and decadent willows in Telephone Draw, both signs of an unnatural fire interval. Note the browse line on willows.

encroachment of meadows and stagnation of forage base (bitterbrush)] The need to keep more roads open for fire suppression activities has affected big game's ability to fully utilize certain habitats Disagreements between government entities over road management and the forage/cover necessary for big game, has resulted in a build up of fuel loading (more opportunity for major fire occurrence), forage (bitterbrush) stagnation, and roads being kept in place that allow increased disturbance, harassment and predation of big game.

Elk

Elk populations throughout the western United States are recovering from a period of severe decline that occurred as a result of over exploitation and the loss of suitable habitat (Thomas et al, 82). Review of available literature on elk strongly suggests that the density of elk is closely tied to the availability of hiding and escape cover, which is directly associated with the density of conifer and hardwood stems. Other studies have shown that road density plays an important role in herd sizes and in population increases; i.e., less roads equals larger herd size and increases in population numbers.

Mule Deer

The analysis area is under a consent decree between the US Forest Service, Klamath Tribes, and Oregon Department of Fish and Wildlife. This decree outlines the responsibilities of the respective governments for the management of mule deer that use former Klamath Tribal Reservation Lands. This document is included as part of the Winema Forest Plan, 1990.

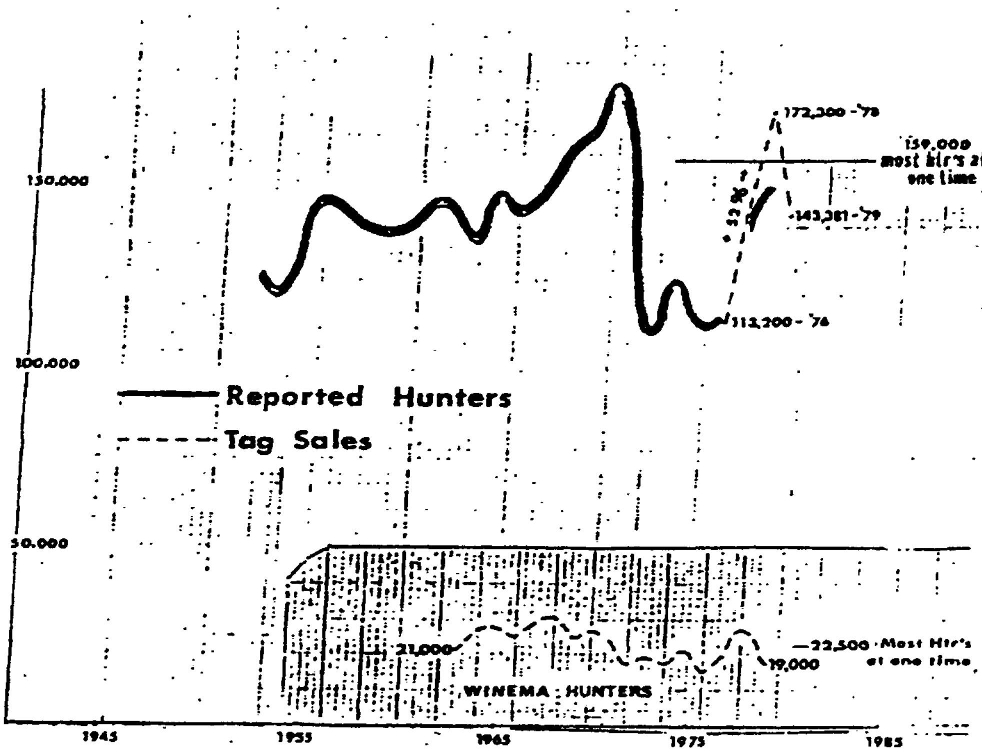
The District and the Forest have implemented management strategies to minimize human activities that disturb mule deer during the fawning season, including restrictions on management activities in key fawning areas (meadows and riparian areas). Livestock utilization levels are monitored to ensure they do not reach levels that would create animal conflicts. Livestock are being rotated so they are not impacting key fawning areas between May 1 and July 15. In addition, some areas are being totally excluded from livestock use. A major problem with this strategy is that though management activities have been restricted, road systems and associated public access remains active. For every mile of developed road, it is not uncommon to encounter one to several intersections of "user" developed roads. The impacts from unlimited access, and these unapproved road systems, has not been adequately addressed as far as their impacts to deer use.

In summary, factors that have influenced the decline of mule deer using the analysis area are:

☞ Natural succession of plant communities without fire.

☞ Predation by humans and other predators continues on a year-long basis, regardless of herd status Legal harvest by the general public has declined, but illegal harvest has probably remained constant (estimated to be about 125% of legal harvest).

☞ Law enforcement for game violations on former reservation lands is minimal. It should be noted that predation is a normal occurrence, and generally does not influence prey populations unless recruitment into the population is below the maintenance level. In some herds recruitment has been highly erratic, and fawn survival has not been sufficient to maintain herd numbers.



Graph from 1980 Winema Project Report, Jack Inman, Winema Forest Biologist Increase in hunters is most noticeable after 1961 (formation of Forest), and after 1975, (last part of reservation becoming National Forest)

- Active roads that cross and parallel most major meadow and riparian systems, allowing human use to continue during critical fawning periods, even though FS management activities are restricted during this time period.

- The severe winter of 1992-93 caused a substantial loss of adults, and deer herds are still recovering from this setback.

- Lack of cooperation between responsible management agencies, and general disagreements on appropriate management strategies for mule deer habitat and populations (Biology + Politics + Regulations + Cultural Practices + Lawsuits + Court Mandates = Resource Loss)

- General migration route disruptions (highways with increased traffic and land developments) between summer range (in analysis area) and winter range

- Loss of both summer and winter ranges on private lands due to subdivisions and clean agricultural practices

- General increase of human activities across the land.

The primary influences that big game can have on other ecosystem processes is when their populations exceed the carrying capacity of the available habitat. This can cause degradation of existing riparian hardwood communities and hinder further development of these communities Also, the successional development of meadow communities can be affected. Deer, due to their low population numbers at this point in time, are not a problem. Elk may become a factor in restoration of riparian communities, as their populations increase and consequent use of these areas expands.

Eagles, Goshawks

The major natural events that affect both eagles and goshawks are storm events with high winds that blow active nests out of trees and/or blow down nest trees resulting in the loss of that year's production. Now, with the increased understory stocking of both conifers and brush, there is a potential for losing nest trees and yearly production through major fire events. Two other natural events that affect eagles/goshawks are: long, cold, wet springs; or extended drought cycles. Drought affects part of their forage base by limiting waterfowl and fish reproduction, and lowering adults' ability to survive. Long, cold, wet springs affect waterfowl production (lowering survival rates), and may also affect young eaglet and goshawk survival.

Man's activities that have lowered habitat usability for these species and their prey base include roads that allow increased disturbance of nesting birds, and ditches/diversions that dewater riparian zones. Livestock grazing has removed hardwoods, destabilized riparian habitats, and affected prey base populations. Past logging has removed nest trees and increased disturbance of nests, affecting survivability of young. Continued fire suppression has increased the potential for major fire events, which can also cause loss of nesting habitat.

Some recent federal management practices have resulted in improved habitat conditions. For instance: restricting harvesting area and time near active nests, banning the use of pesticides, establishing areas for eagle nesting, and restricting grazing activities adjacent to perennial fish-bearing streams and wetlands have all had positive effects on eagle habitat.

However, there continue to be federal management practices that reduce habitat effectiveness, placing nesting habitat at risk. Long-term fire suppression activities, road construction, failure to significantly reduce road densities in eagle management areas, and not getting management plans in place to reduce fire hazards in active nesting territories are all examples.

Beaver

Beaver populations are naturally unstable, experiencing frequent booms and busts. Extended drought cycles, which force beavers to overuse existing hardwoods, cause population declines until the hardwoods recover. Also, extended droughts expose beavers to heavier predation by coyotes, bobcats, cougars, etc. Successional development of conifers results in shading out and reducing hardwoods necessary for beaver forage and shelter supplies.

Man's influence on beavers began with the heavy trapping in the mid-1800's, when whole colonies were eliminated. Probably the more significant effects to beaver habitat began with the introduction of livestock in the late 1800's. Livestock were not managed as actively as today, and grazed either season-long (May through Oct) or year-long, on private lands through most of the 1900's

This resulted in willow communities either being reduced in area occupied, or being eliminated altogether Other management activities such as draining, ditching, and road construction have dewatered historical willow/hardwood areas, from the early 1900's to the present time Fire suppression activities since the late 1920's has encouraged the encroachment of conifers into hardwood areas.

Trout

The most significant causes of change since the reference era include timber harvest, livestock grazing, wetland reclamation, climatic fluctuation and introduction of exotic species.

Climatic conditions in the watershed have resulted in long term water table fluctuations of up to twenty feet during this century. Extended drought periods, along with the presence of cattle, have resulted in large amounts of undercut bank failures and the increased siltation mentioned in the livestock section above. Much of the habitat degradation discussed here has been a result of the cumulative effect of these two factors. Water table fluctuation also directly impacts habitat volume. Much of the channel incision on the river is attributable to a low water table. During the early part of this century extended drought caused Big Springs, on the northwest side of Klamath Marsh, to cease flowing above ground.

Timber harvest in the watershed has dramatically modified the composition of upland vegetation, which may have a deleterious effect on local groundwater, via its impact due to evapotranspiration and shading. Extensive road construction in the watershed also has some influence on groundwater contribution and timing of runoff.

Livestock production impacts the fishery resource in several ways. Habitat has been modified by the breaking down of stream banks and removal of riparian vegetation which has eliminated much of the undercut banks and increased siltation. This has led to broader shallower streams with less hiding cover, less forage production, and warmer water. Trout have abandoned reaches of the river with this combination of impacts. Flood irrigation for livestock production has also warmed and reduced water flows due to increased solar and atmospheric exposure respectively. Irrigation diversion has disconnected some tributary streams from the river (Jackson and Irving Creeks), eliminating spawning and juvenile fish habitat as well as cool water refugia at the former confluences.

Wetland reclamation has removed areas from aquatic forage production and severed aquatic access for terrestrially challenged fauna such as fish. Wetlands also augment water storage and supply additional water during the summer.

The only exotic species of fish introduced into the watershed has been brook trout. These fish are an effective competitor to redbands in the smaller tributaries, and in the high quality habitat in the upper river. They appear to have displaced redbands in Jackson Creek and are dominant in Deep Creek If Jackson Creek were connected to the river, brook trout would likely have a negative impact on juvenile redbands rearing in Jackson Creek. Jackson Creek would probably have a similar mix of brook and redband trout as Deep Creek.

Fish and their habitat influence human uses because of the desire of humans to gather food, interact with nature, and recreate. If post spawning fish die near their spawning grounds high in the watershed. they will transport downstream nutrients back up into the watershed. These carcasses provide additional nitrogen to the system, which is the most limiting nutrient in this watershed. Increasing bioproduction potential produces an additional increment of growth to aquatic and riparian vegetation. as long as the physical inputs such as solar energy are not limiting. Increased riparian and aquatic vegetation can improve bank and channel stability

Recommendations

General

* Evaluate, and close or modify road crossings of riparian areas.

* Continue working jointly with adjacent landowners to improve riparian habitats that involve both FS and private lands.

* Obliterate roads that are not needed for management purposes. Restoration of these roads could include seeding, planting, preparing seed bed for transitional big game forage. (See Appendix E, PFC Chart and Risk Factors, for potential road obliteration projects.

* Use prescribed fire to manage riparian habitats (improve vigor of meadow communities, stimulate willow, aspen growth).

* Use prescribed fire to manage upland habitats (maintain old growth trees by reducing competition for understory conifers and brush, and encourage upland forbs, grasses, and new bitterbrush plants from existing caches).

* Explore using native materials such as lodgepole, instead of fences, for livestock barriers and protection of sensitive areas. This should reduce maintenance costs associated with fencing.

* Monitor all projects to determine successes and failures, so future projects can be designed for success.

Fish Habitat

* Characterize habitat and monitor change via a continuing program of level II stream surveys.

* Develop and refine riparian hardwood cultivation techniques in riparian zones.

* Identify critical aquatic refugia habitat via high resolution thermal infra-red aerial photographic analysis. Identify discrete features by using remote thermographs.

* Maintain connectivity of tributaries via a healthy water table and prevention of mass sedimentation of the tributaries' lowest reaches by improper road construction and land use practices.

* Improve stream edge cover by deep planting riparian hardwoods and sedges One idea for rehabilitation of riparian hardwoods is to drill into the banks three feet, with native willow stock. in order to establish vegetation on the outside bends of the river. Mike McNeil, USFS Hydrologist. believes the raw banks may erode as much as one foot per year. By rooting into the bank three feet, the starts get time to establish before the soil erodes It is logical to expect erosion rates to slow as root structure development begins to armor the banks.

* Stabilize channel and reduce sediment load on the river, lower Deep Creek, and wherever future surveys indicate the need, by deep planting riparian hardwoods and sedges and excluding livestock from riparian zones. Sedge and rush plugs placed in the banks may also add to bank stability. Beaver shouldn't significantly damage planted sedge and rush since they're not as palatable as willow and there is currently a great deal of sedge available. These plants grow quickly and have excellent root mass. There is some concern that sedge only root in the wettest soil and would vegetate only a narrow band of a steep incised bank. When undercuts form under vegetation, the overhanging bank may be vulnerable to sloughing off if the water level drops sufficiently below the roots of the riparian vegetation. It seems that upper bank weight could cause the banks to slough if they aren't buoyed up by the water during dry climate cycles. Roots need to travel deep into the bank in order to effectively protect the overhang. With willow starts drilled into the bank four feet, a strong tie-in would be more assured. If beaver eat willow starts, the roots of deep planted starts may survive so the plant can regenerate. Ideally they will only eat what is exposed, instead of pulling the whole start out of the bank.

* Improve midstream cover via expansion of submerged aquatic macrophyte community by improving channel stability and reducing sediment load.

* Investigate the potential of an aquatic connection of Jackson Creek to the river, at least during the spawning and outmigration periods. If spawning habitat can be reestablished, brook trout should be eradicated from the creek to eliminate competition that could preclude reproductive success of redbands.

* Survey Deep Creek for rainbow trout spawning activity.

* Improve fall through spring forage habitat by insuring channel connection to Klamath Marsh and continuity of marsh channels.

* Differentiate between temperature and cover as habitat limiting factors by comparing fish densities in cooler water areas with little cover to warmer areas with more substantial cover.

<u>Threatened and Endangered Aquatic Species</u>

* Survey the watershed for Miller Lake Lamprey and conduct a life history study to identify methods of habitat improvement.

* Carry out habitat improvement projects

VII. HUMAN USES

Step 1: What are the major human uses, including tribal uses and treaty rights? Where do they generally occur in the watershed?

Major human uses of the watershed are best discussed as those centered on Klamath Tribes treaty rights and cultural practices and those centered on non-tribal uses. Klamath tribal uses focus on hunting, fishing, camping, firewood cutting, plant gathering, and traditional religious practices. Non-tribal uses include recreational hunting, fishing, and camping; commercial timber harvest; firewood cutting; and ranching, especially livestock grazing.

Klamath tribal uses center on the exercise of treaty rights and the practice of cultural traditions. The Upper Williamson River Watershed lies wholly within the former Klamath Indian Reservation. In 1864 the Klamath Treaty was signed by the Klamath, Modoc, and Northern Paiute Yahooskins. These are three distinct groups, although the Klamath and Modoc spoke dialects of the same language. The treaty, which was signed again by the chiefs in 1869, and ratified by Congress and signed into law in 1870, set aside one million acres as a reservation (Stern 1966:42). Members of the Klamath Tribes were granted exclusive rights to hunt, fish, gather and trap within the reserved area, and they were to be protected there from any unauthorized non-Indian use.

In 1953 a policy was designed, under House Concurrent Resolution 108, to terminate federal relationship with Indian Tribes (USDA-FS 1995:15). The Klamath Tribes were included with several groups chosen for the termination experiment under the Klamath Termination Act of 1954. By 1961, most tribal lands were sold, special federal programs were discontinued, state legislative jurisdiction was authorized (except for hunting and fishing rights, which were not terminated), and tribal sovereignty was ended (USDA-FS 1995:16).

In 1961 the Winema National Forest, which included most of the former Klamath Indian Reservation lands, was created. Under Forest Service management, lands were opened to non-Indian hunting, fishing, and recreation. Hunting remains an important focus for public land use in the watershed.

The Klamath Tribes were restored as a federally recognized tribe in 1986, but reservation lands were not. With the restoration of the Tribes, focus has turned to defining government-to-government relationship with the Forest Service and to commenting on projects that may affect game herds and fish populations. Treaty rights to hunt and fish were retained on former reservation lands, and this was reaffirmed in 1981 by the Kimball vs. Callahan decision. The Klamath Tribes also are concerned for the protection of cultural heritage sites, for the maintenance of plant collection areas, for unrestricted use of summer camps, and for access to religious sites.

Since the former reservation lands have been only recently terminated (1954), most of the uses the watershed relate to Bureau of Indian Affairs management. Grazing was emphasized from the earliest days, both to provide a ranching basis for tribal members as well as to generate revenues under non-Indian grazing leases. Timber production became a major emphasis after 1910, when the reservation was opened to commercial timber harvest. Non-Indian recreational uses occurred only after the reservation was terminated, and came under management of the Winema National Forest and Klamath Forest National Wildlife Refuge in 1961.

Step 2: What are the current conditions and trends of the relevant human uses in the watershed?

Current human uses in the watershed center around hunting, fishing, dispersed recreation, timber harvest, grazing, and wood cutting. Maintenance of deer herds for hunting is of concern to tribal members as well as other hunters who use the area.

Tribal Uses

The Klamath Tribes retain treaty rights to hunt and fish year round; deer and elk are the primary capture species. Fishing was extremely important in native Klamath subsistence, but changes in species abundance, among other reasons, has diminished the emphasis on fishing. Tribal members also collect wocus (water lily) seeds in Klamath Marsh and have strong cultural values associated with heritage sites located around the marsh.

Some tribal members gather native medicinal and food plants, but no plants have been identified that are uniquely gathered for religious ceremonial purposes. Plants gathered today for food, medicine or materials include epos, camas, wocus, serviceberry, currant, wild rose, cattails, and tules. Among these, the collection of wocus seeds is important as a means to celebrate and renew cultural traditions. As described in Step 3 below, wocus was once central to Klamath Indian subsistence; its collection today reaffirms cultural identity by maintaining important values and traditions.

Lands included within the Upper Williamson River watershed include several unique cultural areas, especially those relating to spiritual uses on Yamsi Mountain. Seasonal hunting camps, administered under special use permit to the Tribes, are located at Rocky Ford. Similar hunting camps are located on Jackson Creek and elsewhere in the watershed, although these are not under special use permit at present. In addition to serving as the basis for exercising hunting and fishing treaty rights, these camps are places to socialize, make jerky, tell stories, and renew cultural traditions. Camps on Rocky Ford and Jackson Creek also are important relative to certain traditional religious uses of nearby Yamsi Mountain. The top of Yamsi Mountain and the camps at Rocky Ford and Jackson Creek are considered eligible to the National Register of Historic Places, due to the traditional cultural values and uses associated with these areas.

Timber Production

Timber production and firewood gathering in the Upper Williamson Analysis Area has been sporadic since the early 1900's. Timber production was not significant until the 1940's, during World War II. Records do not indicate very accurately how much volume was extracted during this time other than indicating that fairly large harvests were conducted under fairly short time frames. Some contracts called for removing large volumes within two to three months. The next significant period of harvest started during the late 1970's and extended through the mid-1980's. Also during this time frame, the Long-Bell Tract owned by Weyerhaeuser Company was heavily harvested. As timber supplies became tighter during the 1990's, some other private landowners along the Williamson River began harvesting the timber under their control.

Firewood Gathering

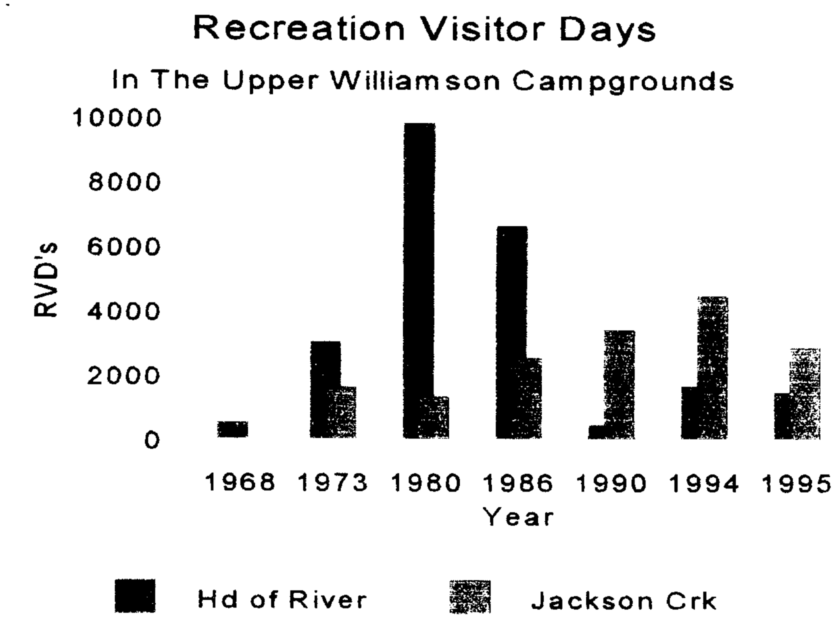
Firewood cutting in the watershed was not very significant until the mid-1980's, when sources closer to Klamath Falls and Chiloquin were exhausted. From the late 1980's and into the early 1990's, firewood gathering in the area increased. A large area between the Williamson River Road and the Skellock Draw Road (FS road 49) and east of FS Road 4582 (Buckhorn Springs Road) was opened for free-use Firewood cutters have traversed most of the meadows for pockets of dead lodgepole pine.

Prior to Forest Service administration, most firewood gathered tended to be ponderosa pine. This practice was discontinued in the early 1980's, after concerns were raised about the loss of this resource for cavity nesters and roosting perches for raptors, especially eagles.

Recreation

The major recreational use in the Upper Williamson Analysis Area is primarily dispersed recreation on public lands. There are two reduced service campgrounds on Forest Service administered lands: one is located at Head of the River; the other is located on Jackson Creek. Recreation user days information is listed below.

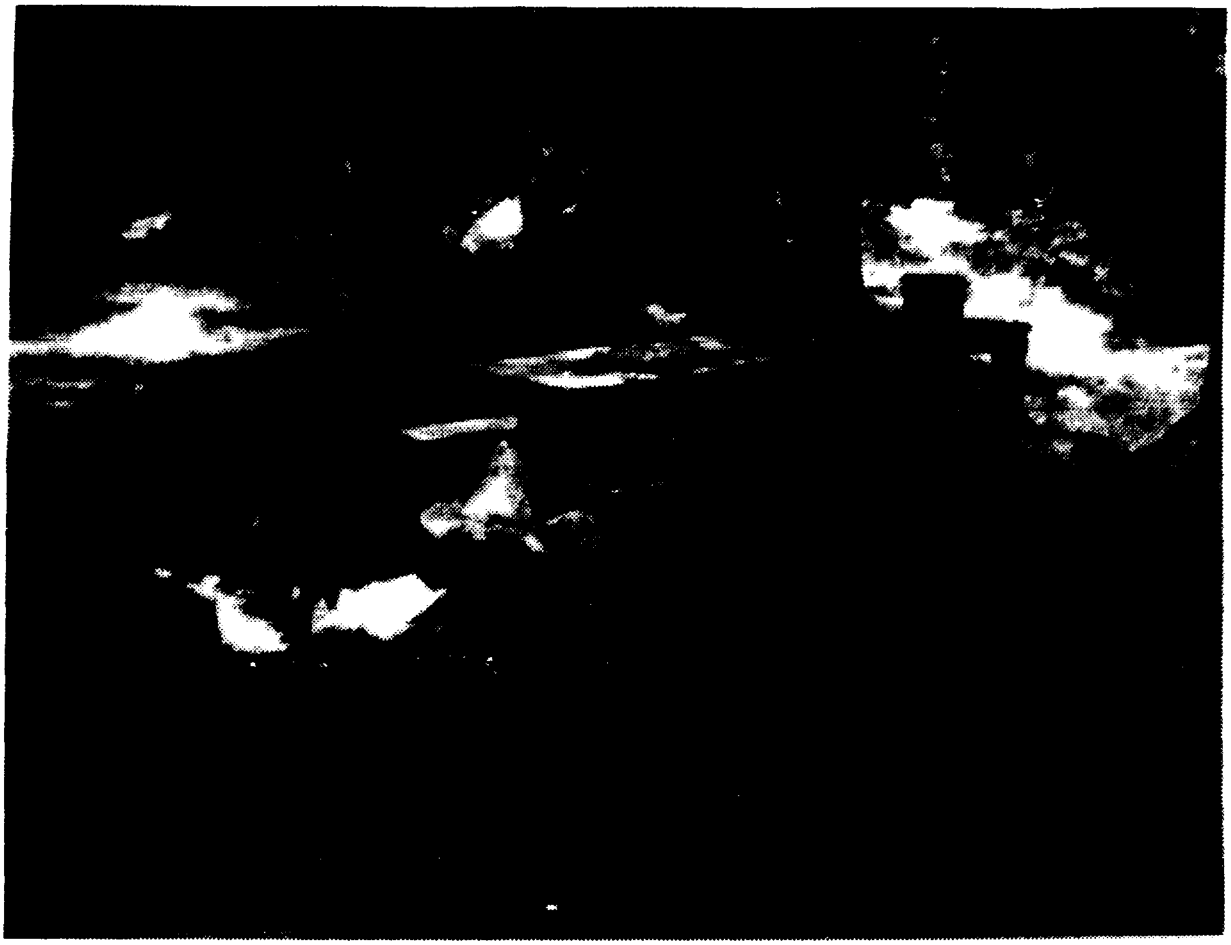
Recreation use at Head of the River campground was reduced in 1984, by limiting the number of camping units and restricting vehicle movement. Pole fencing was installed to prevent further resource damage.



The major types of dispersed recreation are associated with big game hunting, fishing, firewood gathering, and waterfowl hunting at Klamath Marsh and along the Williamson River. Other minor activities include sightseeing, horseback riding, and birdwatching. Recreation on private lands, conducted primarily for profit, include fee fishing, hunting for waterfowl, and bed/breakfast operations These private land operations are just starting, and could become a bigger factor in the recreational picture as traditional income sources (livestock grazing, timber production) become less viable in the next 20 to 50 years

Increased human usage has resulted in some deleterious effects. Among them are

- Increased dumping of trash and littering by locals and visitors
- Increased disturbance of both game and non-game wildlife
- Increase in the number of human caused fires
- Increase in presence of semi-permanent, man-made structures, detracting from the natural beauty of the area



Trash accumulation at recreational site on the Williamson River.

Grazing

Grazing and livestock production has played an important role in changing the function of riparian and aquatic systems within the analysis area. Grazing practices and development of pasture lands, both in and outside the analysis area, have contributed towards lowering water tables within the analysis area. Most of these activities occurred during the first half of this century. Diversions, ditches, and pumping water to either drain wetter areas, and/or irrigate drier pastures on private lands has played a major role in changing the composition of plant species, and the extent of water dependent riparian plant communities.

Historically, grazing has occurred either season-long and on some private lands year-long. The effects from this has been to reduce or eliminate hardwood communities that are associated with live water sources, either developed or natural. Grazing in more recent times (since the 1980's) has been undergoing dramatic changes in both numbers, intensity of grazing, areas excluded from grazing, and management of livestock. Klamath Forest Marsh Wildlife Refuge is partly in and adjacent to the Upper Williamson Analysis Area. The change in livestock use after the US Fish & Wildlife Service acquired private lands is substantial.

Step 3: What are the major historical human uses in the watershed, including tribal and other cultural uses?

Upper Williamson River and Klamath Marsh were important parts of Klamath Indian life before the advent of EuroAmerican settlement. Winter villages were located along the edges of the marsh, and summer villages were located along the upper Williamson River. The marsh provided abundant plant foods, waterfowl, and year-round fishing.

Of special significance to the Klamath were the vast expanses of wocus (or water lily) seeds covering the marsh. Nutritious, and storable over the long hard winters, the abundance of wocus seed served as an important staple of Klamath subsistence.

In 1902, the botanist Frederick Colville estimated that 10,000 acres of continuous wocus covered Klamath Marsh (Colville 1902:727-729). The Klamath developed an elaborate technology centered on the harvest and processing wocus. Special tools, like the two-handed muller, were invented specifically to grind wocus seeds. Whether collected as free floating mature seeds, or still green in their hard pods, each stage had a special name and elaborate processing method. Seeds were parched, fermented, and boiled or baked, depending upon the specific nature of the harvested seed. The technological, linguistic, and cultural elaboration associated with wocus use, and the persistence of Klamath Marsh as a shallow water body over several thousand years, suggests this plant has long been available for use by the Klamath,.

Several early historic views of portions of the watershed are available in the form of early explorers' accounts. Following Indian Trails into the Klamath Basin, the earliest historic accounts of the area are from fur trappers' journals. Peter Skene Ogden traveled along the east side of Klamath Marsh between November 29 and December 2, 1826. His account speaks eloquently of hunger, cold, scarce game, and virtually none of the beaver for which they were searching (Davies 1961). Ogden visited an Indian village apparently built on piles in the marsh and approachable only by canoe. Although friendly to Ogden's party, the Indians expressed regret that a communication had been opened to their lands (November 29, 1826).

John C. Fremont followed the same Indian trail used by Ogden between December 10 and 15, 1843. Fremont camped on the west side of the marsh at present Military Crossing and then traveled up Skellock Draw and crossed over the lower slopes of Yamsi Mountain. In contrast to Odgen's bleak view of Klamath Marsh in 1826, Fremont (1845) found it "...a picturesque and beautiful spot; and under the hand of cultivation, might become a little paradise" (December 11, 1843). He did not, however, present the Klamath Indians as friendly but highlighted the importance of the area as "... the line of inland communication with California, and near to Indians noted for treachery, it will naturally in the progress of settlement of Oregon, become a point for military occupation and settlement" (December 11, 1843).

Ten years after Fremont's journey, Leuts. R.S. Williamson and Henry L. Abbot explored the Klamath Basin in search of a railroad route linking the Sacramento Valley and the Columbia River (Abbot 1857). At their camp on the east side of Klamath Marsh near Military Crossing on August 21, 1855, Abbot provides a more detailed picture of Klamath Marsh as " a strip of half-submerged land, about twelve miles long and seven miles broad....covered by clumps of tule and other aquatic plants separated by small sheets of water. Thousands of ducks, plover, and other water birds made it their home" (Abbot 1857). By this time, the Klamath fled at the approach of the exploring party, no longer trusting to any friendliness. It was the time of the wocus harvest, and Williamson noted the "large quantities of food, mostly consisting of the seeds of water plants and dried fish...." (Abbot 1957).

By the 1860s, traditional life ways of the indigenous peoples was already much disrupted and the Klamath, Modoc , and Yahooskin Paiute agreed to sign a treaty ceding most of their traditional lands in exchange for an area to be set aside for their exclusive use. The three groups combined ceded about 15 million acres of their native territories with the treaty of 1864. In the original treaty language, a reservation was to be formed extending between prominent, named peaks. The "peak-to-peak" reservation included about 2,738,598 acres (as calculated by GIS); however, several factors were underway even as the treaty was being signed, that reduced the Reservation to less than half this size. By the time the land surveys were conducted between 1871 and 1900, settlers were already occupying lands in the basin; and it was felt by some in the Indian Agency that the original peak to peak reservation was too large. The Thiel survey of 1888, which eventually came to demarcate the outside boundary of the Reservation, consisted of 1,196,872 acres. Enclosed within this, however, is a 90,000 acre block of land that came to be known as the Yamsi (or Long-Bell) Tract.

In 1864, the same year the treaty was signed, a group of entrepreneurs organized a company and built the Oregon Central Military Wagon Road through the center of the reservation. Although never used by the military (nor by anyone else for that matter), the road builders were granted every other section of land along its route. No one seems to have noticed that the road grants traversed the center of the Klamath reservation until almost 30 years later. The land grants were upheld by a 1906 ruling, and to resolve the problem, a block of land encompassing 90,000 acres in the center of the reservation was exchanged for the 110,000 acres scattered along the military road. The Klamath were not compensated for this land until 1938. This block, known as the Yamsi Tract or Long-Bell tract, is presently owned by Weyerhaeuser Lumber Company. It is managed for its timber values.

The General Allotment (or Dawes) Act of 1887 was intended to individualize Indians by giving them citizenship and assigning them private tracts (160 acres), to be held in trust by the United States for at least 25 years. The Klamath Reservation was considered best suited to stock raising, and the Klamath Marsh was one of the best areas for putting up hay and raising stock.

Individual family allotments were located in bottom lands along streams in the vicinity of the pre-reservation villages. Klamath Marsh was the most densely populated area, with winter villages located along its south and east edges (Spier 1930).

The allotment policy, however, did not provide sufficient lands to sustain families as farmers or stockmen, and the leasing of individual allotments to non-Indians became common practice. By 1903, payments from leases comprised 30% of total estimated personal income (Stern 1966:143). However, the leasing policy made regulation of stock difficult to impossible, especially on adjacent communal tribal lands. It is likely that unregulated stock initiated many watershed problems we see today.

Leasing was soon replaced by a movement to sell the allotted lands. The original 160 acres per family was minimal for self sufficiency, and so the leasing, but when divided among numerous heirs, the tracts often became "dead allotments" which did not produce anything (Stern 1966:144). This encouraged the rapid transfer to patents in fee simple and resulted in land sales to non-Indians. By 1924, practically all fee patents had been sold. Of the 1,624 allotments issued, totaling 247,515 acres, 1,130 allotments amounting to 133,000 acres remained in August 1954. By October 1957, 630 tracts remained, totaling 73,681 acres (Stern 1966:145). However, the impetus toward self- sufficiency based on farming and stock raising had been supplanted much earlier with the opening of the reservation to commercial timber harvest after 1910.

When the Southern Pacific Railroad reached Klamath Falls in 1909 and moved north to Kirk in 1911, the reservation timber was opened to commercial markets (Tonsfeldt 1987). Cutting on allotted lands began in 1911. In 1913, the first tribal timber was sold. Superintendent Edson Watson proposed the exploitation of tribal timber, arguing that it would provide work for the Indians. He recommended that the reservation timber be cut on a sustained yield basis in fifty to one hundred year rotations. He advocated large sales of stumpage, as involving lower administration costs, and considered small concerns unreliable (Annual Narrative Report 1914:8, 11-13; cited in Stern 1966:152).

The Upper Williamson River Watershed includes portions of five timber management units, three of which were harvested as individual sales in the reservation era - generally between 1940 and 1955. By this time, railroad technology had largely been supplanted by truck hauling methods. Unfortunately, historic records do not preserve acarid data on volumes harvested from lands presently managed by the Forest Service. The Yamsi Tract was harvested heavily; between 1929 and 1948, 1,400 mmbf were logged from the tract. Logs were hauled over Lamm's mainline railroad across Klamath Marsh. Lamm's Railroad is a significant historic site considered eligible to the National Register of Historic Places.

Step 4: What are the causes of change between historical and current human uses? What are the influences and relationships between human uses and other ecosystem processes in the watershed?

Changes in human uses in the watershed primarily relate to the transfer of lands from Klamath Indian Reservation, under BIA administration, to public lands under Forest Service management. Reservation lands were set aside for exclusive Indian use. The terms of the 1864 Treaty relegated the Klamath Tribes from a state of sovereign independence to a status under the government of the United States, and more directly, under the supervision of an Agent. A program of extensive change was initiated, one designed to make tribal members into farmers and ranchers by American standards. It is probable "...that both parties to the treaty thought the Indians would be able to maintain self-sufficiency by the end of twenty years" (Stern 1966:42).

The Klamath Reservation was considered best suited to stock raising, and the Klamath Marsh was one of the best areas for putting up hay and raising stock. Families who maintained wocus (water lily seed) gathering camps along the marsh were allotted lands here (Stern 1966). Hence, the continuity of traditional culture was maintained into the historic reservation era through the maintenance of family allotments at the marsh. The leasing policy, however, made regulation of stock difficult to impossible, especially on adjacent communal tribal lands. It is likely that unregulated stock initiated many watershed problems we see today.

The allotment policy failed to make tribal members self-sufficient based on farming and stock raising. After 1910, tribal revenues were generated by opening the reservation to commercial timber harvest. Large volumes of timber were cut from the reservation, changing the shape and composition of the original pine forest. With the termination of the reservation after 1954, lands came under management of the Winema National Forest and Fish and Wildlife Service. This history of land transfer and management is central to the numerous issues facing both federal land managers and the Klamath Tribes.

Primary effects from recreational activities are the increased off-road use on public lands. As more use occurs, non-system roads in riparian areas may become channelized. This will result in further degradation of riparian communities, as new downcut areas will cause changes in plant species composition and reduce surface water retention capacity in the areas affected. Recreational users may also affect water quality, and can damage sensitive heritage resources.

As stated above, the changing of ownership from the Klamath Tribes to the Forest Service has played an important role in increasing the level of activity by both Tribal members and the general public, and the influence of these activities on the resources of the watershed. The increased access to this area was primarily due to the increase in road and railroad systems that were developed for timber harvesting. These roads by themselves have affected mesic riparian communities and water storage. The road system plays an important part in increasing the number of user-created roads in riparian areas for general recreating, hunting, and firewood gathering. The effects of existing roads, combined with these added user roads, are cumulative on wildlife disturbance. This makes recruitment into existing populations of both game and non-game difficult, and further degrades riparian systems that are key to the general health of the watershed, precluding these areas from being able to store groundwater on a long term basis.

Increased recreation, combined with subsistence, has led to increased trash dumping, some of which, may have long term effects on water quality, and wildlife, due to the toxic nature of the trash (ex. motor oil, radiator fluid, cleaners, etc.).

The results of long-term fire suppression, combined with recreation and subsistence use, has set the stage for potential large scale man-caused fire conflagrations that may affect long-term productivity and health of the watershed.

The development of agricultural lands, both in and outside of the analysis area, has exacerbated the trend of decreasing water retention, through ditching, pumping water, and livestock grazing. It has generally changed some of the mesic riparian communities to a more xeric riparian or upland community.

Recommendations

- → Work with State Fish and Game officials to educate the public on the frailties of the ecosystem, and how to avoid making unnecessary negative impacts. This could be accomplished with flyers attached to hunting licenses.
- → Increase the level of law enforcement, as well as the number of game wardens.
- → Start and/or continue educating the public on the effects of off-road vehicle use on riparian areas, wildlife, and watersheds.
- → Attach flyers to wood cutting permits, asking that vehicles be kept out of riparian/meadow areas.
- → Work with Klamath Tribes and recreational groups to ensure that trash is removed from Tribal camps and dispersed campsites.
- → Continue to work with and educate private landowners and livestock grazers on the effects to the ecosystem of drainage ditches/diversions, and cattle grazing in sensitive riparian areas.

REFERENCES

Abbott, H.L.. 1857. Report of Lieutenant Henry L. Abbott, Corps of Topographical Engineers, upon explorations for a railroad route from the Sacramento Valley to the Columbia River, 1855. Explorations and Surveys for a Railroad Route from the Mississippi River to the Pacific Ocean. U.S. Documents Set 763. Washington, D.C..

Behnke, R.J.. 1992. Native Trout of Western North America. American Fisheries Society Monograph 6.

Blackwood, T., K.E. Baitis, M. Reiter, T.R. Turner, and R.J. Danehy. 1996. Deep, Sand, Aspen and Coyote (Creeks) Watershed Analysis. Weyerhaeuser Co., Tacoma.

Buchanan, D.V., A.R. Hemmingsen, D.L. Bottom, R.A. French, and K.P. Currens. 1989. Native Trout Project. Oregon Department of Fish and Wildlife Research Project F-136-R, Annual Progress Report, Portland.

Buchanan, D.V., A.R. Hemmingsen, and K.P.Currens. 1994. Native Trout Project. Oregon Department of Fish and Wildlife Fish Research Project F-136-R-07, Annual Progress Report, Portland.

Carlson, Garwin.. 1979. Soil Resource Inventory Winema National Forest, Pacific Northwest Region, Winema National Forest, Klamath Falls.

Coville, Frederick V.. 1902. Wokas, a Primitive Food of the Klamath Indians. Report of the National Museum, 1902, pp 727-739. Washington D.C.. Smithsonian Museum.

Davies, K.G., ed.. 1961. Peter Skene Ogden's Snake Country Journal, 1826-27, vol. 23. Hudson's Bay Record Society, London.

Eastman, D. L.. 1974. Summary of Summer Track Count 1964 - 1974 "Sprague Unit". Oregon Department of Fish and Wildlife. Aug, 1974.

Foster, Craig L.. 1994. Final Report Fort Rock/South Central Elk Telemetry Study. Oregon Department of Fish and Wildlife. Aug, 1994.

Frazier, Brent D.. 1994. A Historical Summary of Livestock Grazing on Former Lands of the Klamath Tribes Currently Part of the Winema and Fremont National Forests. Winema National Forest Document. April, 1994.

Fremont, B.J.. 1845. Report of the Exploring Expedition to the Rocky Mountains in the Year 1842, and to Oregon and California in the Years 1843-44. S. Exec. Doc. 174, 28th Congress, 2nd Session, Washington, D.C..

Hemmingsen, A.R., D.V. Buchanan, D.L. Bottom, R.A. French, K.P. Currens, and F.C. Shrier. 1988.

Hemmingsen, A.R., D.V. Buchanan, D.L. Bottom, R.A. French, K.P. Currens, and F.C. Shrier. 1988. Native Trout Project. Oregon Department of Fish and Wildlife. Fish Research Project F-136-R, Annual Progress Report, Portland.

Inman, Jack. 1980. Winema Inter-Agency Coordination of Management Objectives for Mule Deer of Fort Rock, Silver Lake, Sprague, Klamath Falls, and Keno Units. Winema National Forest Document. Nov, 1980.

Johnson, D.M., R.R. Petersen, D.R. Lycan, J.W. Sweet, M.E. Neuhaus, and A.L. Schaedel. 1985. Atlas of Oregon Lakes. Oregon State University Press. Corvallis.

Leonard, A.R. and A.B. Harris. 1974. Ground Water in Selected Areas in the Klamath Basin, Oregon. USGS, Klamath County and Pacific Power and Light.

Minckley, W.L., D.A. Hendrickson, and C.E. Bond. 1986. Geography of Western North American Freshwater Fishes: Description and Relationships to Intracontinental Tectonism. Pages 519-613 in Hocutt, C.H. and E.O. Wiley, editors, The Zoogeography of North American Freshwater Fishes, John Wiley and Sons, New York.

Nelson, C.H., P.R. Carlson, and C.R. Bacon. 1988. The Mount Mazama climactic eruption (approx. 6900 yr B.P.) and resulting convulsive sedimentation on the Crater Lake caldera floor, continent, and ocean basin. Geological Society of America Special Paper 229.

Olson, R. and W.A. Hubert. 1994. Beaver: water resources and riparian habitat manager. University of Wyoming. Laramie.

Oregon Department of Fish and Wildlife Big Game Population Status Reports. 1995.

Rosgen, Dave. 1996. Applied River Morphology. Wildland Hydrology. Pagosa Springs, CO.

Salinas, J.. 1985. Miller Lake: A Limnological Survey. Report CAS-9502. Winema National Forest, USDA. Klamath Falls, Oregon.

Spier, Leslie.. 1930. Klamath Ethnography. University of California Publications in American Archaeology and Ethnology, Volume 30.

Stern, Theodore. 1966. The Klamath Tribe: A People and Their Reservation. University of Washington Press, Seattle, Washington. 356 p.

Tonsfeldt, Ward. 1987. Mills along the Lakeshore: The Lumber Industry on the Winema Lands 1910-1936. Report prepared under Winema National Forest contract #53-04U3-6-0007. On file Winema National Forest, Klamath Falls, Oregon. 202 p.

Tonsfeldt, Ward. 1995. Reconnaissance and Evaluation of Historic Railroad Systems, Chiloquin and Chemult Ranger Districts, Winema National Forest. Report prepared under Winema National Forest contract #53-04U3-1-00055. On file Winema National Forest, Klamath Falls, Oregon. 264 p.

Troendle, C. A.. 1986. The Potential Effect of Partial Cutting and Thinning on Streamflow from the Subalpine Forest. Tes. Pap. RM-274. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station.

USDA Forest Service. 1995. Forest Service National Resource Book on American Indian and Alaska Native Relations - Working Draft 1995. USDA Forest Service, Washington DC. p. 76.

USDA Forest Service, PNW. 1983. Guidelines for Sampling some Physical Conditions of Surface Soils. p. 34.

USDI, BIA. 1930-1947. BIA Grazing Summaries, Klamath Indian Reservation.

USDI, BLM. 1993. Riparian Area Management. Process for Assessing Proper Functioning Condition. Technical Reference 1937-9. p. 51.

USDI, BLM. 1994. Riparian Area Management. Process for Assessing Proper Functioning Condition for Lentic Riparian-Wetland Areas. Technical Reference 1737-11. p. 37.

USGS 1992. Chemical Analyses of Surface Water Samples in Upper Klamath Basin - Nutrient Assessment Study. Portland, OR.

Williams, H.. 1942. The Geology of Crater Lake National Park, Oregon. With a Reconnaissance of the Cascade Range Southward to Mount Shasta. Carnegie Institution of Washington Publication 540, Washington D.C..

Whaley, Wayne H. & White, Clayton M. 1994. Trends in Geographic Variation of Cooper's Hawk and Northern Goshawk in North America: A Multivariate Analysis, Volume 5 Number 3, Western Foundation of Vertebrate Zoology.

Winema National Forest Records

Subregional Ecological Assessment Team Report
Forest Recreation records for Head of the River and Jackson Creek Campgrounds

Chiloquin District Records

Deep Creek, Skellock, and Yamsi Allotment Files.

Chemult District Records

Jack Creek Allotment File

APPENDIX

A

Management Intensities

Management Area 1A
Yamsay Mountain Semiprimitive Recreation Area

Goal

This management intensity provides semiprimitive nonmotorized recreation opportunities in a predominantly natural-appearing environment in the Yamsay Mountain area.

Description

At 8,900 acres, the Yamsay Mountain Semiprimitive Recreation Area is located on the eastern boundary of the Forest, adjacent to the Buck Creek Roadless area on the Fremont National Forest. Existing roads in the area have been closed, and motorized use is prohibited. The area will be managed to provide opportunities for hiking, horseback riding, dispersed camping, and hunting.

Desired Future Condition

The desired future condition is a diversity of natural-appearing vegetative communities, meadows, and rock outcroppings. The area provides the visitor with a high probability of experiencing solitude, and interaction between users is low. A trail to the top of Yamsay Mountain and a series of loop trails provide nonmotorized access. The Desert to the Crest (Intertie) Trail may pass through the area, providing a long distance trail opportunity.

Intensity-Specific Standards and Guidelines

Recreation

1. The area shall be managed to provide a semiprimitive nonmotorized recreation setting.

2. A trail shall be constructed from Jackson Creek Campground to the top of Yamsay Mountain where it will tie into the Fremont National Recreation Trail (NRT). Additional trails should be added to provide a system of loops. These trails will provide a riding opportunity in a semiprimitive setting without the restrictions on group size required in wilderness. A trailhead and horse camping facilities should be added near Jackson Creek Campground to facilitate this use.

3. Motorized vehicle use will be excluded except for emergencies and administrative purposes when approved by the Forest Supervisor.

Minerals and Energy

1. Surface occupancy should not be allowed.

Management Area 2 - Developed Recreation

Goal

Management Area 2 provides a variety of recreation opportunities and development levels at developed recreation sites. Emphasis is to meet the demand for developed camping, except on holiday weekends.

Description

This management area is applied to lands that currently have developed recreation facilities or are identified as potential development sites. These facilities include Forest Service operated sites--such as campgrounds, picnic areas, boating sites, trailheads, and sno-parks--and privately operated sites like resorts, organization sites, and recreation residences.

Desired Future Condition

The desired future condition is developed recreation occurring in a natural-appearing forest environment. A variety of recreation activities are supported by the appropriate facilities. These include picnicking, camping, boating, swimming, hiking, riding, cross-country skiing, and snowmobiling. Developed recreation areas are generally accessible by passenger car.

Standards and Guidelines

Specific standards and guidelines that apply to all management intensities of this management area are stated in this subsection.

Recreation

1. Areas shall generally be managed to provide roaded natural or rural Recreation Opportunity Spectrum (ROS) settings.

2. Motorized vehicles shall be restricted to designated routes and areas. Some trails or areas may be designated for nonmotorized activities only, such as hiking, biking, or cross-country skiing.

3. A site plan for any recreation development shall be prepared before construction. The plan shall be prepared or reviewed by a journey-level landscape architect and approved by the Forest Supervisor. "As built" site plans for existing sites shall be prepared or updated to show current and proposed facilities.

4. Developed recreation sites shall be designed, administered, and maintained to provide a quality experience for the visitor, to provide for public health and safety, to protect the site resources and facilities, and to minimize operation and maintenance costs (FSM 2330).

5. Existing sites should be upgraded and/or expanded to accommodate user needs before new sites are constructed. Compatible facilities and sites should be concentrated in recreation complexes to provide a variety of opportunities in one area and to minimize operating costs.

6. New or additional facilities to add capacity shall be planned when the average weekend use exceeds 90 percent of the designed persons-at-one-time (PAOT) of the site or when use for the managed peak use season exceeds 90 percent of the Practical Maximum Capacity.

Scenic

1. Management activities in the environment surrounding recreation sites shall achieve the retention visual quality level, except in lodgepole pine salvage areas.

Timber

1. Timber harvest shall not be programmed.

2. Timber management activities shall be utilized to maintain overall, healthy stand conditions and to maintain or to enhance recreational values in accordance with an approved vegetation management plan. Such activities within existing sites normally shall occur during non-use or low-use periods.

3. Hazardous trees or limbs will be removed before opening sites to public use.

Water, Soil, and Air

1. Comply with State requirements in accordance with the Clean Water Act for protection of waters of the State of Oregon, including the antidegradation policy for high quality waters, through implementation of General Water Quality Best Management Practices.

2. In areas with concentrated recreation use, the percent of area impacted by detrimental soil conditions (compaction) may exceed forestwide standards. Facilities should be designed and arranged to concentrate and to direct traffic flow to reduce impacts. Site-hardening measures used should be appropriate for the designed development level.

Minerals and Energy

1. Salable mineral material sources should not be developed.

2. Dead and down logs for firewood may be gathered within a recreation area or site for use in that area.

Lands

1. Landownership classification group 2 applies to this management area.

2. This management area is an avoidance area for new transportation and utility corridors.

Facilities

1. With full consideration to public safety, roads and trails shall be constructed and maintained to standards that are consistent with recreation opportunities and the level of service needed.

2. New facilities shall be designed to blend with the natural setting and to visually compliment existing structures.

Protection

1. All wildfires shall be aggressively suppressed by using low-impact methods as much as practical. During high fire danger periods, rapid attack may be appropriate, using all available tactics to ensure public safety and to protect improvements.

2. Fuel treatment methods that minimize adverse effects like removal and chipping shall be used within developments. Treatment normally would occur during non-use or low-use periods.

Management Intensities

The following management intensities may be applied.

Management Area 2A
Developed Recreation, Low Level Development

Goal

This management intensity is designed to provide recreation opportunities in minimally developed, forested areas.

Description

This management intensity is applied to lands with predominantly development level 2 recreation facilities. Some level 3 facilities may be present. Little site modification is evident. Improvements are rustic and designed primarily for protection of the site rather than convenience of the user. Examples of sites in this intensity are Corral Springs, Scott Creek, Odessa, Jackson Creek and Head of the River campgrounds, Wood River Picnic Area, Sevenmile Marsh and Cold Springs Trailheads, and Pelican Cut Boat Launch. Access to these areas may not always be maintained for passenger car use. These sites receive relatively low recreation use, but may have peak use periods during hunting season, for example.

Desired Future Condition

The desired future condition is meeting customer needs by providing minimally developed recreation sites in a natural-appearing forest environment. To meet increases in demand, some of the more popular sites may be upgraded to higher development levels and managed at a higher intensity. However, a variety of minimally developed sites will be retained at locations desired by users.

Intensity-Specific Standards and Guidelines

Recreation

1. Areas managed at this management intensity shall provide a roaded natural recreation setting, except those sites in lodgepole pine impacted by the pine beetle. These sites may be managed in the short term to provide a roaded modified setting.

Minerals and Energy

1. New salable mineral material sources should not be developed.

2. Existing mineral material sources should not be expanded into scenic areas.

3. Existing mineral material sources shall be analyzed for short-term mitigations to achieve scenic objectives and long-term rehabilitation measures. Partial rehabilitation of a material source should be considered when that part no longer is of use for development.

4. Reasonable access for the exploration and/or development of locatable and leasable minerals shall be allowed but shall be highly controlled to protect scenic values.

5. Except for road access, surface occupancy should not be allowed.

Lands

1. Landownership classification group 3 applies to this management area. Disposal of lands should occur only if lands of equal or higher scenic quality shall be acquired.

2. Special-use permits shall be permitted for structures that existed before designation of lands to scenic emphasis. Rehabilitation should be emphasized for any structures that do not blend with the landscape.

3. New special uses may be permitted when they are consistent with the management objectives and are justified through an environmental analysis.

4. This management area is an avoidance area for new transportation and utility corridors.

Facilities

1. Roads, parking lots, and other necessary facilities shall be designed to flow with the typical lines and slopes in the landscape and/or shall be screened by natural vegetation.

2. Closed roads should appear natural with large logs and boulders partially buried to blend with the area and should be tilled and revegetated with trees, shrubs and grasses, as appropriate to the location.

Management Intensities

The following management intensities may be applied.

Management Area 3A
Scenic Management, Foreground Retention

Goal

The primary emphasis for this intensity is to retain the natural-appearing condition of the foreground areas. The retention visual quality objective means that activities may only repeat whatever form, line, color, and texture are frequently found in the characteristic landscape. Changes in their qualities–such as size, amount, intensity, direction, and pattern–may not be evident.

Description

This management intensity is applied to lands visible for distances up to .25 mile from selected travelways, bodies of water, or public use areas. This area focuses on the detail in the landscape; the detail includes individual tree shape, color, size, species mix, and related vegetation like shrubs and grasses. Vegetation may be manipulated to achieve desired character through enhancing large diameter trees, opening a vista to provide an attractive view, or creating a small space to encourage new growth of desired vegetation.

Desired Future Condition

The desired future condition is the same as the areawide condition. In addition, large tree character is emphasized and maintained perpetually in the foreground area through retaining groupings of large-diameter trees and by having large trees sometimes scattered individually among other tree size classes. To achieve diversity, small openings with natural-appearing edges may be created. Overall, trees with distinctive bark and tree form characteristics, including occasional character snags, are very evident. Natural-appearing forms, colors, and textures dominate to create a high quality scenic condition.

Intensity-Specific Standards and Guidelines

The following standards and guidelines apply to the foreground retention intensity of the scenic management area.

Scenic

1. Evidence of management activities from projects that produce slash (tree harvest) or charred bark (underburning) will not be noticeable one year after the work has been completed.

Timber

1. Large tree character will be perpetually retained in the foreground retention area in all species, except lodgepole pine, through maintaining three to five large diameter trees (between 30 inches and 36 inches DBH) on the average per acre. These should be distributed in groupings for greatest visual effect. Some areas may have high numbers of large diameter trees, and other areas may have fewer small clumps. Openings may or may not have mature large-diameter trees; if not, more trees will be retained on other acres to maintain the three-to-five-trees-per-acre average in the foreground overall.

2. In ponderosa pine and pine associated areas where uneven-aged management will prevail, the objective is to achieve a healthy, multiaged forest with timber stands that contain a variety of tree sizes up to 36 inches DBH following harvest. At least three canopy levels or size classes are present within each stand.

3. For even-aged and group selection management, the long-term objective is to achieve the mix of tree size classes shown in table 4-22.

4. Stumps, if visible, shall be cut to approximately 6 inches or less in height on the uphill side of the stump.

5. Thinning units should be irregularly marked (vary the density of leave trees) in the immediate foreground to break up the viewing distance and to provide diversity.

6. Landings, decks, major skid roads, temporary roads, and slash piles shall be located to utilize vegetative or landform screening opportunities. These should be located away from critical line-of-sight viewing areas.

Protection

1. Fire suppression efforts in the immediate foreground should use low-impact methods. If heavy equipment is needed on high-intensity fires, rehabilitation may be needed to mitigate the effect on the visual resource.

2. Harvest residues resulting from management activities should not be evident after residues treatment.

TABLE 4-22
Scenic Foreground Retention Tree Size Class Objectives
Even-Aged and Group Selection Management Strategies

Working Group	DBH (Inches)	Percent of Area in DBH Class
Ponderosa Pine, or Pine Associated, or and Mixed Conifer	30-36 22-30 16-22 9-16 0-9	20 20 20 20 20
Lodgepole Pine	9+ 5-9 0-5	50 25 25

Table 4-23 summarizes the critical elements necessary to achieve the retention visual quality level in foreground.

TABLE 4-23
Scenic Foreground Retention Standards by Working Group

Critical Element	Ponderosa Pine (Uneven)	Pine Associated (Uneven)	Mixed Conifer (Even-aged)	Lodgepole(1) Pine (Even-aged)
Target diameter for mature portion of the stand (inches)	36	36	34	-(2)
Maximum created openings size (acres)(3)	2	2	3	8
Maximum area in created openings in any one decade (percent)	4	4	4	-
Maximum area in created openings at one time (percent)	8	8	8	-
Linear feet of created opening along road frontage/decade/mile of road	300	300	200	-
Target stand appearance	Open, park-like, mature groups of trees with deeply fur-rowed, yellow-colored bark within a mix of varying age classes.	Mature trees in tight, dense groups of various spe-cies and ages.	Mature trees in tight, dense groups of various spe-cies and ages.	Even-aged, mature groups of trees within a mosaic of varying ages.

(1)The mountain pine beetle infestation has resulted in relaxed operating standards to achieve the visual quality objective in the long term.
(2)In lodgepole pine, rotation age (80 years), not diameter, is the controlling factor.
(3)For visual management purposes, a created opening is no longer considered to be an opening when the vegetation within it reaches an average of 20 feet in height and (for foreground retention purposes) may include from three to five large-diameter trees per acre.

Management Area 3B
Scenic Management, Foreground Partial Retention

Goal

The goal is to provide attractive scenery that is slightly altered from a natural condition as viewed in the foreground. Activities may repeat or introduce form, line, color, or texture common or uncommon to the characteristic landscape, but changes in their qualities of size, amount, intensity, direction, and pattern must remain visually subordinate to the visual strength of the characteristic landscape.

Description

This management intensity may be applied to lands visible for distances up to .25 mile from selected travelways, bodies of water, or public use areas. This area focuses on the detail in the landscape: individual tree shape, color, size, species mix, and relatod vegetation like shrubs and grasses. Vegetation may be manipulated to achieve desired character through enhancing large diameter trees, opening a vista to provide an attractive view, or creating a small space to encourage new growth of desired vegetation.

Desired Future Condition

The desired future condition is the same as the areawide condition. In addition, large tree character is emphasized and maintained perpetually in the foreground in all species, except lodgepole pine, through retaining large-diameter trees in groupings and by having large trees sometimes scattered individually among other tree size classes. To achieve diversity, small openings with natural-appearing edges may be created. Overall, trees with distinctive bark and tree form characteristics, including occasional character snags, are very evident. Management activities may be noticeable, but they remain subordinate to the natural landscape character.

Intensity-Specific Standards and Guidelines

The following standards and guidelines apply to the foreground partial retention intensity of the scenic management area.

Scenic

1. Evidence of management activities from projects that produce slash (tree harvest) or charred bark (underburning) should not be noticeable from two to three years after the work has been completed.

Timber

1. Large tree character will be retained in the foreground area in all species, except lodgepole pine, through maintaining three to five large diameter trees (between 24 inches and 30 inches DBH) on the average per acre. These should be distributed in groupings for greatest visual effect. Some areas may have high numbers of large diameter trees, and other areas may have fewer small clumps. Openings may or may not have mature large diameter trees; if not, more trees will be retained on other acres to maintain the three-to-five-trees-per-acre average in the foreground overall.

2. In ponderosa pine and pine associated areas where uneven-aged management will prevail, the objective is to achieve a healthy, multiaged forest with timber stands that contain a variety of size classes up to 30 inches DBH following harvest. At least three canopy levels or size classes are present within each stand.

3. For even-aged and group selection management, the long-term objective is to achieve the mix of tree size classes shown in table 4-24

4. Stumps, if visible, shall be cut to approximately 6 inches or less in height on the uphill side of the tree.

5. Thinning units should be irregularly marked (vary the density of leave trees) in the immediate foreground to break up the viewing distance and to provide diversity.

6. Landings, decks, major skid roads, temporary roads, and slash piles should be located to the rear of the stands to use vegetative or landform screening opportunities. These should be located away from critical line-of-sight viewing areas.

Protection

1. Harvest residues resulting from stand management activities may be evident but should blend, where possible, with the surrounding landscape characteristics.

2. Hand tools are the preferred method for fire suppression in the immediate foreground. Mitigation or rehabilitation measures may be necessary for high-intensity fires.

TABLE 4-24
Scenic Foreground Partial Retention Tree Size Class Objectives
Even-Aged and Group Selection Management Strategies

Working Group	DBH (Inches)	Percent of Area in DBH Class
Ponderosa Pine, or Pine Associated, or Mixed Conifer	24-30	20
	18-24	20
	12-18	20
	6-12	20
	0-6	20
Lodgepole Pine	9+	50
	5-9	25
	0-5	25

Table 4-25 summarizes the critical elements necessary to achieve partial retention in the foreground.

TABLE 4-25
Scenic Foreground Partial Retention Standards by Working Group

Critical Element	Ponderosa Pine (Uneven)	Pine Associated (Uneven)	Mixed Conifer (Even-aged)	Lodgepole(1) Pine (Even-aged)
Target diameter (inches)	30	30	30	-(2)
Maximum created openings size (acres)(3)	2	2	5	10
Maximum area in created openings in any one decade (percent)	6	6	6	-
Maximum area in created openings at one time (percent)	12	12	12	-
Linear feet of created opening along road frontage/decade/mile of road	500	500	250	1,000
Target stand appearance	Open, park-like, mature groups of trees with deeply fur-rowed, yellow-colored bark within a mix of varying age classes.	Mature trees in tight, dense groups of various spe-cies and ages.	Mature trees in tight, dense groups of various spe-cies and ages.	Even-aged, mature groups of trees within a mosaic of varying age classes.

(1)The mountain pine beetle infestation has resulted in relaxed operating standards to achieve the visual quality objective in the long term.
(2)In lodgepole pine, rotation age (80 years) is the controlling factor.
(3)For visual management purposes, a created opening is no longer considered to be an opening when the vegetation within it reaches an average of 20 feet in height and (for foreground retention purposes) may include from three to five large-diameter trees per acre.

Management Area 3C
Scenic Management, Middleground Partial Retention

Goal

This management intensity provides attractive scenery that is slightly altered from a natural condition as viewed in the middleground. Activities may repeat or introduce form, line, color, or texture common or uncommon to the characteristic landscape. Changes in their qualities of size, amount, intensity, direction, and pattern must remain visually subordinate to the visual strength of the characteristic landscape.

Description

This management intensity may be applied to lands visible for distances of .25 mile to 5 miles from selected travelways, bodies of water, or public use areas. This area focuses on the texture and form in the landscape where groups or stands of trees are similar as a unit compared with others that differ in size, degree of texture (fine, medium, or coarse), or pattern. A continuous forest canopy is usual; variety is provided by the addition of natural openings, rimrock, or rock outcrops that are typical in the landscape.

Desired Future Condition

The desired future condition is similar to the areawide condition. In addition, masses of vegetation rather than individual trees are evident. Varying canopy levels with natural-appearing edges and careful perpetuation of forested ridgelines create a mosaic. Created openings imitate natural occurrences in the landscape, while the characteristic landscape is retained. Activities repeat form, line, color, or texture common to the characteristic landscape. Activities may introduce changes in form, line, color, or texture that are found infrequently or not at all in the characteristic landscape, but they must remain subordinate to the visual strength of the characteristic landscape.

Intensity-Specific Standards and Guidelines

The following standards and guidelines apply to the middleground partial retention intensity of the scenic management area.

Timber

1. For individual tree selection (uneven-aged management), the long-term objective is to achieve a healthy, multiaged forest with timber stands that contain a variety of size classes up to 24 inches DBH following harvest. At least three canopy levels or size classes are present within each stand.

2. For even-aged and group selection management, the long-term objective is to achieve the mix of tree size classes shown in table 4-26.

3. Even-aged management may be applied to achieve diversity where stands of different ages are located adjacent to each other. Uneven-aged management also may be applied when appropriate.

4. Landings, decks, and slash piles should use vegetative or landform screening opportunities. These should be located away from critical line-of-sight viewing areas.

TABLE 4-26
Scenic Middleground Partial Retention Tree Size Class Objectives
Even-Aged and Group Selection Management Strategies

Working Group	DBH (Inches)	Percent of Middleground Area in DBH Class
Mixed Conifer or Pine Associated	16-18	20
	12-16	20
	8-12	20
	4-8	20
	0-4	20
Lodgepole Pine	9+	25
	6-9	25
	2-6	25
	0-3	25

Table 4-27 summarizes the critical elements necessary to achieve the partial retention visual quality objective in the middleground.

TABLE 4-27
Scenic Middleground Partial Retention Standards by Working Group

Critical Element	Ponderosa Pine (Uneven)	Pine Associated (Uneven)	Mixed Conifer (Even-aged)	Lodgepole(1) Pine (Even-aged)
Target diameter for mature stand component (inches)	24	24	18	-(2)
Average created openings size (acres)(3)	2	2	15	20
Maximum area in created openings in any one decade (percent)	8	8	8	-
Maximum area in created openings at one time (percent)	16	16	16	-

(1)The mountain pine beetle epidemic has resulted in relaxed operating standards to achieve the visual quality objective in the long term.
(2)In lodgepole pine, rotation age (80 years), not diameter, is the controlling factor.
(3)For visual management purposes, a created opening is no longer considered to be an opening when the vegetation within it reaches an average of 20 feet in height.

Management Area 7 - Old-Growth Ecosystems

Goal

Management Area 7 is designed to provide, maintain, and enhance existing mature and old-growth communities for associated wildlife species, mature successional stage diversity, preservation of natural gene pools, and aesthetic qualities.

Description

This management area may be applied to coniferous or deciduous vegetative communities that have been identified as, or have the potential to become, old-growth ecosystems based on the criteria developed by Hopkins (1989 draft).

Management indicator species that use old-growth communities are: northern spotted owl, pileated woodpecker, northern goshawk, three-toed woodpecker, and marten.

Desired Future Condition

The desired future condition is old-growth environments of mature and overmature communities of lodgepole pine, ponderosa pine, mixed conifer, ponderosa pine and associated species, and mountain hemlock/subalpine fir, as well as stands of cottonwood or aspen.

Following are descriptions and criteria for old-growth conifer stands by working group.

Characterization of Existing Lodgepole Pine Old-Growth Forests

Lodgepole pine typically does not maintain itself in an old-growth state on a given acre that is generally associated with other ecosystems found in this area. The old-growth state is present but tends to be very transitory on the landscape. As one area reaches old-growth state and then deteriorates, another area reaches old-growth state. Therefore, when considering the value of a lodgepole pine old-growth area, one must consider the larger view.

The following stand criteria must be used to evaluate old-growth lodgepole pine.

1. Overstory: It consists of at least 120 mature trees per acre (approximately 19 foot spacing) greater than 12 inches in diameter. There should be an adjacent younger stand with well-distributed trees greater than 7 inches diameter at breast height (DBH). Species composition in both stands is almost entirely lodgepole pine, and an occasional ponderosa pine may be present.

2. Other tree layers: Very little layering occurs in lodgepole pine old-growth stands. Small groups of younger trees may occur from past disturbances.

3. Snags: There should be a minimum of three snags per acre greater than 6 inches DBH.

4. Shrubs and herbs: Bitterbrush and manzanita make up the majority of the shrub cover that ranges in canopy closure from zero to 50 percent. Idaho fescue and needlegrass are generally the herbs present.

5. Woody material component: Large woody material ranges from zero to 30 logs greater than 6 inches in diameter (as measured at the large end) and over 8 feet long.

6. Natural openings: Natural openings generally will be less than 5 percent of the area.

7. Size: The area should be a minimum of 500 contiguous acres arranged to maximize internal integrity and should have elements of immature, mature, overmature, and decadent tree components. The immature elements should not occupy more than one half of the area. In addition, there should be an adjacent 250 acres of younger age classes that will provide future replacement to the above components.

Characterization of Existing Ponderosa Pine Old-Growth Forests

At least seven considerations regarding structure are found in old-growth ponderosa pine forests. These seven structural considerations apply to all major sites throughout the range of the ponderosa pine forests. The following conditions are for climatic climax, which differs from the historic open, park-like stands representing fire climax.

1. Overstory: The overstory consists of between 10 and 20 large ponderosa pine trees greater than 21 inches DBH per acre. Stocking of the large overstory trees may vary from five to 30 per acre. Smaller components in the stand will generally be less than 20 percent of the trees per acre of the large tree component.

2. Other tree layers: In addition to the large tree component, at least two additional layers will be recognizable (seedlings or saplings or poles).

3. Snags: There should be a minimum of three snags per acre greater than 14 inches DBH.

4. Shrub and herbs: Shrub canopy cover ranges from 20 percent to 40 percent and is associated with a variety of herbaceous plants such as grasses, sedges, and forbs. Canopy closure in the shrub components can vary from zero to 60 percent.

5. Woody material component: Large wood material ranges from three to six logs greater than 12 inches (as measured at the large end) and over 8 feet long. The variance found may be from zero to 10 logs per acre.

6. Natural openings: There may be small openings (up to one half acre) created by natural causes like beetle kill, windthrow, lightning, or wildfire.

7. Size: The size of the area should be no less than 200 contiguous acres arranged as to maximize internal integrity and should have elements of mature, overmature, and decadent tree components;

The following conditions are for fire climax ponderosa pine. These open park-like stands are of less value for wildlife then climatic climax ponderosa pine but have aesthetic value.

1. Overstory: The overstory consists of 4 or more large ponderosa pine trees greater than 30 inches DBH per acre. Smaller components are generally absent. This creates an open, park-like appearance in the stand.

2. Other tree layers: Other layers are generally absent. Incidental individual smaller sized trees may be present.

3. Snags: Snags may or may not be present. The role of snags may be fulfilled by dead tops in live trees.

4. Shrubs and herbs: Shrubs and herbs may be absent.

5. Woody material component: May be absent.

6. Natural openings: Openings created by beetle kill, windthrow, lightning, or wildfire may occur.

7. Size: The size of the area should be no less than 10 contiguous acres and must be adjacent to or an inclusion of climatic ponderosa pine or pine associated old growth stands.

Characterization of Existing Pine Associated Old-Growth Forests

The following conditions reflect climatic climax, which differs from historic stands greatly structured by regular wildfire, creating forests referred to as fire climax forests. This characterization describes those forests where ponderosa pine is a dominate life form.

1. Overstory: The overstory consists of between 30 and 40 large trees greater than 28 inches DBH. Species composition should be from 18 to 67 ponderosa pine per acre, zero to 12 white fir per acre, zero to 15 Douglas-fir per acre, and four to six other conifer species per acre.

2. Other tree layers: In addition to the large tree component, at least two additional layers will be recognizable (seedlings or saplings or poles).

3. Snags: There should be a minimum of six to 10 snags per acre greater than 14 inches DBH.

4. Shrubs and herbs: Shrub canopy cover ranges from 20 percent to 50 percent with a variety of herbaceous plants such as grasses, sedges, and forbs covering zero to 50 percent of the areas. The shrub component will be dominated by snowbrush, but manzanita, pinemat manzanita, and golden chinquapin will be present. In some stands, the brush cover may be as low as 2 percent.

5. Woody material component: Large woody material ranges from 12 to 14 logs greater than 12 inches (as measured at the small end) and over 8 feet long.

6. Natural openings: There may be small openings (up to one half acre) created by natural causes like beetle kill, windthrow, lightning, root rot, or wildfire.

7. Size: The size of the area should be no less than 350 acres and should be arranged as to maximize internal integrity and should have elements of mature, overmature, and decadent tree components.

Characterization of Existing Mixed Conifer Old-Growth Forests

This characterization reflects higher-elevation forests where a combination of white fir, Douglas-fir, and Shasta red fir assume dominance over other coniferous species.

1. Overstory: The overstory consists of 11 to 38 large trees greater than 27 inches DBH. Species composition should be from zero to 33 white fir per acre, zero to 22 Douglas-fir

per acre, zero to 38 Shasta red fir per acre, and less than nine other conifer species per acre.

2. Other tree layers: In addition to the large tree component, at least three additional layers will be recognizable (seedlings or saplings or poles).

3. Snags: There should be a minimum of six to 12 snags per acre greater than 14 inches DBH.

4. Shrubs and herbs: Shrub canopy cover ranges from 25 percent to 40 percent with mainly long-stolon sedge and a few native grasses. The shrub component will be dominated by snowberry, manzanita, or pinemat manzanita.

5. Woody material component: Large woody material ranges from 12 to 14 logs greater than 12 inches (as measured at the small end) and over 8 feet long.

6. Natural openings: There may be small openings (up to one half acre) created by natural causes like beetle kill, windthrow, lightning, root rot, or wildfire.

7. Size: The size of the area should be no less than 250 acres. It should be arranged as to maximize internal integrity and should have elements of mature, overmature, and decadent tree components.

The following priorities shall be followed in selecting areas to be managed as old-growth ecosystems.

1. Select areas meeting all of the criteria listed.

2. Select areas that have a total rating index of 42 or greater using the ecological significance matrices developed by Hopkins (1989 draft).

3. Select areas that do not have a rating of 42 or greater because of deficiencies in dead standing trees or dead down material but meet all other criteria for a 42 rating.

Management indicator species and their respective habitats are described below. Individual areas that could be utilized by more than one management indicator species are noted.

Northern Spotted Owl

The desired future condition is old-growth mixed conifer communities that provide the required habitats necessary for foraging and nesting of northern spotted owls. Contiguous core nesting areas are maintained within the surrounding forage areas. These areas are typified by varied species composition and stand structure diversity such as snags, umbrella crowns, down trees, natural cavities, and various height categories and crown closures. Nesting pileated woodpeckers and northern goshawks may be present.

Pileated Woodpecker

The desired future condition is multistoried mature and old-growth stands of mixed conifer, ponderosa pine, and ponderosa pine and associated species, as well as riparian areas of large cottonwood or aspen trees, that provide the preferred nesting and feeding habitats for pileated woodpeckers. Snags of appropriate species, size, and density are available, as well as dead and down woody material and heart rot. Snags for nesting and foraging are surrounded by mature or old-growth timber and are clumped in small patches throughout the nesting habitat. Nesting northern goshawks may be present.

Northern Goshawk

The desired future condition is mature and old-growth ecosystems available for nesting/foraging in the ponderosa pine, mixed conifer, ponderosa pine and associated species, and lodgepole pine plant communities. The characteristics of these communities include multistoried canopies comprised of mature tree crowns with subcanopies of shade-tolerant conifer species of various ages and heights. Included within the nesting/foraging areas are north-facing talus slopes or cliffs, water sources, and all downed logs potentially used as northern goshawk plucking/feeding sites.

Three-Toed Woodpecker

The desired future condition is selected vegetative communities of mature and old-growth lodgepole pine or mountain hemlock/subalpine fir stands. Trees used for nesting are standing dead trees, live trees with dead limbs, or live trees with rotted heartwood. In most cases, the limbs or trunks of these trees have maintained a hard outer shell. Trees infested with bark and wood-boring insects are available for foraging. Effects of fire, insect epidemic, blow down, or other die off are often visible. Nesting northern goshawks may be present.

Marten

The desired future condition is mature and old-growth mountain hemlock or high-elevation lodgepole pine ecosystems. These communities consist of multicanopied stands containing a high diversity of understory plant species. Special and unique habitat components include talus slopes, rock piles and crevices, cliffs and rims, snags, stumps, and dead and down woody material. Nesting northern goshawks and three-toed woodpeckers may be present.

Standards and Guidelines

There is only one management intensity for this management area. Specific standards and guidelines that apply to this management area/intensity are stated in this subsection.

Recreation

1. Provide a range or recreation opportunity settings except for Roaded Modified, Rural or Urban.

2. Developed recreation (for example, campgrounds and resorts) is not compatible with the goals of this management area, and shall not be allowed. Dispersed recreation developments shall be discouraged.

Scenic

1. Management activities shall meet the inventoried visual quality level of the specific areas.

Wildlife and Fish

1. Provide suitable mature and old-growth nesting and foraging habitat for at least the minimum required number of pairs of management indicator species (as determined by Regional Office direction). These minimum numbers are: nine pairs of northern spotted owls, 51 pairs of martens, 28 pairs of pileated woodpeckers, 87 pairs of northern goshawks, and 215 pairs of three-toed woodpeckers.

A. Northern spotted owl nesting area requirements are as follows.

1. A minimum of 1,500 acres of old-growth mixed conifer stands shall be provided for each pair of northern spotted owls.

2. Of the 1,500 acres, a 300-acre core area of contiguous old-growth habitat shall be designated as breeding habitat for northern spotted owl. The remaining 1,200 acres of old-growth habitat shall provide foraging habitat but does not need to be contiguous. Foraging habitat shall be located within 1.5 miles of the core area and shall consist of stands larger than 30 acres.

3. The distance between core areas shall be no greater than 6 miles. Clusters consisting of three or more spotted owl habitat areas (SOHAs) may be up to 12 miles apart.

4. Disturbing human activities within .5 mile of an active northern spotted owl nest site shall be discouraged or minimized from March 1 through September 30 (refer to forestwide standards and guidelines). Where the actual nest site has not been located, disturbance shall be discouraged or minimized within the 300-acre core area during the above-mentioned nesting period.

B. Pileated woodpecker area requirements are as follows.

1. A minimum of 300 acres of old-growth and/or mature mixed conifer, ponderosa pine and associated species, or ponderosa pine stands shall be provided as breeding and primary foraging habitat for one pair of pileated woodpeckers. These woodpeckers may also nest in large aspen or cottonwood trees associated with riparian areas.

2. Pileated woodpecker habitat should be contiguous where possible; otherwise, stands shall be at least 50 acres in size and not more than .25 mile apart.

3. Within the 300-acre primary breeding area, a minimum average of two hard snags per acre greater than 12 inches DBH shall be maintained as follows.

   a) Forty-two suitable nesting snags (hard) greater than 20 inches DBH shall be available within the 300-acre primary breeding area.

   b) Within the 300-acre breeding area, 558 hard snags greater than 12 inches DBH will be maintained.

4. An additional 300-acre feeding area shall be provided in adjacent management areas. Refer to forestwide standard and guideline X-X for specific direction.

5. Pileated woodpecker areas shall be dispersed throughout suitable habitat, not more than 5 miles apart from the center of one area to the center of another area.

6. Disturbing human activities within .25 mile of an active pileated woodpecker nest site shall be discouraged or minimized from March 1 through July 31 (refer to forestwide standards and guidelines).

C. Northern goshawk area requirements are as follows.

1. A minimum of 60 acres of contiguous old-growth and/or mature mixed conifer, ponderosa pine and associated species, ponderosa pine, and lodgepole pine

plant communities shall be provided as primary breeding and foraging habitat for one pair of northern goshawks.

2. Northern goshawk areas shall be dispersed throughout suitable habitat, not more than 5 miles apart from the center of one area to the center of another area.

3. Disturbing human activities within .25 mile of any active northern goshawk nest shall be discouraged or minimized from March 1 through August 31 (refer to forestwide standards and guidelines).

D. Three-toed woodpecker area requirements are as follows.

1. A minimum of 75 acres of contiguous old-growth and/or mature lodgepole pine or subalpine fir shall be provided as primary breeding and foraging habitat for one pair of three-toed woodpeckers.

2. Three-toed woodpecker areas shall be dispersed throughout suitable habitat, not more than 2.5 miles apart from the center of one area to the center of another area.

3. Within the 75-acre primary breeding area, a minimum average of two hard snags per acre greater than 10 inches DBH shall be maintained as follows:

   a) Forty-five suitable nesting snags (hard) greater than 12 inches DBH shall be available within the 75-acre primary breeding area.

   b) Within the 75-acre breeding area, 105 hard snags greater than 10 inches DBH shall be maintained.

4. Disturbing human activities within .25 mile of an active three-toed woodpecker nest site shall be discouraged or minimized from April 15 through July 15 (refer to forestwide standards and guidelines).

E. Marten area requirements are as follows.

1. A minimum of 160 acres of contiguous mature and/or old-growth mountain hemlock or high elevation lodgepole pine shall be provided as a territory for one breeding female. This also constitutes part of a territory for a breeding male; this territory covers several female territories.

2. Marten areas shall be dispersed throughout suitable habitat, not more than 3 miles apart measured center to center.

Timber

1. Timber harvest shall not be programmed.

2. Timber management techniques may be used to enhance low quality stands to greater potential.

Range

1. Old-growth ecosystems selected for management shall be protected from adverse impacts of livestock.

Minerals and Energy

1. New salable mineral material sources shall not be developed, and existing developments shall not be expanded into areas managed for old-growth values.

2. Reasonable access for the exploration and/or development of locatable and leasable minerals shall be allowed but shall be highly controlled to protect old-growth values.

3. Except for road access, surface occupancy should not be allowed.

4. Personal use or commercial firewood cutting permits shall not be issued for these areas.

Lands

1. Landownership classification group II applies to this management area. However, opportunities may become available where disposing of an existing old-growth stand may allow land acquisition in another area that would enhance the overall old-growth distribution.

2. This management area is an avoidance area for transportation and utility corridors.

Facilities

1. Road closures in specific areas and during specific periods shall be used to protect the resource.

2. New road and other facilities construction shall be avoided in this area.

Protection

1. Fire shall be suppressed in a manner which best retains old-growth ecosystem character.

Management Area 8 - Riparian Areas

Goal

Riparian area management is designed to protect soil, water, wetland, floodplain, wildlife, and fish resource values associated with riparian vegetative communities and adjacent drier ecosystems. Management emphasis is on water quality, deer fawning, wildlife habitat, and aquatic ecosystems. Existing conditions will be maintained or enhanced.

Description

This management area may be applied to lands that are characterized by streams, lakes, ponds, springs, and wetlands--including seeps, bogs, wet and moist meadows, and wet and moist conifer plant associations. It includes riparian ecosystems and transitional ecosystems as defined by "Riparian Zone Associations" (R6 Ecol TP-279-87, Kovalchik). Also included are nonriparian areas adjacent to streams, lakes, and wet meadows that must be carefully managed to protect riparian values.

Specific boundaries of this management area are identified during project level planning.

Desired Future Condition

The desired future condition is riparian vegetative communities containing openings and meadows interspersed with stands in various successional stages. These stands differ in age, species composition, density, and size. Riparian vegetation provides wildlife habitat and adequately protects floodplains, bank stability, and water quality. Few roads and other facilities are present within the riparian area.

Standards and Guidelines

Specific standards and guidelines that apply to all management intensities of this management area are stated in this subsection.

Throughout this set of standards and guidelines, the term "riparian area" is synonymous with the term "riparian zone" as used in the "Riparian Zone Association Guide for Area IV."

Recreation

1. The area shall be managed for a full range of recreation opportunity settings.

2. Primary recreation emphasis shall be placed in dispersed recreation.

3. The visual quality level shall be consistent with adjacent area objectives, and typically will be partial retention or better as a result of other riparian area standards and guidelines.

4. Recreation facilities placed in riparian areas shall be designed to protect riparian values.

Wildlife and Fish

1. Dead woody material and cavity-nester habitat shall be provided by managing dead trees at the 80 percent potential population level for cavity nesters (Thomas 1979) in forested areas. Green trees shall be managed for future replacements for dead trees.

2. New roads within 0.25 mile of a riparian area shall be located in a manner as to provide for greatest topographic and vegetative screening of the riparian area.

3. Wildlife habitat improvements may be permitted.

Range

1. Where a combination of high soil moisture and fine soil texture results in stream banks susceptible to early season trampling damage, grazing shall be delayed to a late season period (Clary and Webster 1989).

2. Where stream banks or channels are highly erodible, the stubble height at the end of the grazing period shall exceed 4 inches. Under extreme conditions, the area may need permanent protection or removal of grazing for long periods (Clary and Webster 1989).

3. Water developments for livestock or wildlife in riparian areas shall be designed to protect riparian values.

4. Salting areas shall be located on uplands outside of riparian areas.

5. Sheep bedding areas shall be located on uplands outside of riparian areas.

Soil and Water

1. Riparian area management objectives shall be described for a specific zone along a stream or wetland within the proposed project area. As a minimum, the following areas shall be evaluated during the preparation of the objectives:

   a) an area within 100 feet of the normal high water line of Class I, II, or III streams (for protection of water quality and wildlife habitat);
   b) an area within 25 feet on each side of Class IV streams;
   c) any timbered area within 200 feet of wet meadows (to provide wildlife hiding cover);
   d) the entire area of a wetland, including the farthest reaches of the riparian vegetative influence; and
   e) any seeps and springs.

2. The cumulative total area of detrimental soil conditions in riparian areas shall not exceed 10 percent of the total riparian acreage within an activity area. Detrimental soil conditions include compaction, displacement, puddling, and moderately or severely burned soil.

3. Fish habitat and riparian area improvement projects shall be permitted.

Timber

1. Timber harvest shall not be programmed within 100 feet of Class I and II streams and within 50 feet of Class III streams. In other riparian areas, timber harvest shall be programmed.

2. Stocking level control may be delayed if necessary to provide big game cover or habitat diversity.

3. Directional fell and yard away from all stream channels (classes I-IV) and wet areas. Logs yarded over streams shall be fully suspended where practicable.

4. Landings should not be located within riparian associations as defined by "Riparian Zone Associations" (R6 Ecol TP-279-87, Kovalchik).

5. Uneven-aged management in the ponderosa pine, pine associated, and mixed conifer working groups shall be designed to maintain healthy, multistoried stands that contain various size classes up to 36 inches DBH following harvest. The lodgepole pine working group shall receive a variety of silvicultural treatments to meet the management area objectives.

6. Existing stands of hardwood species should be protected or enhanced.

Minerals and Energy

1. New salable mineral material sources should not be developed, and existing developments should not be expanded into riparian areas.

2. Reasonable access for the exploration and/or development of locatable and leasable minerals shall be allowed but shall be be highly controlled to protect riparian values.

3. Except for road access, surface occupancy should not be allowed.

Lands

1. Landownership classification group III applies to this management area. Disposal of lands shall occur only if riparian lands of equal or higher quality shall be acquired.

Facilities

1. New road construction in riparian areas should be avoided. Where road construction is unavoidable, roads should cross riparian areas perpendicular to the landform. System and temporary roads should not be constructed through the length of a riparian area. System and temporary roads crossing a riparian area shall not alter stream or ground water flow characteristics to a degree that will adversely affect the riparian characteristics.

2. Existing roads within riparian areas should be evaluated for opportunities to reduce impacts on riparian values.

3. New water developments and reconstruction of developments for road dust abatement and fire control, for example, in riparian areas shall be designed to protect riparian values.

Protection

1. Wildfire suppression methods that minimize effects on the soil and on riparian ecosystems shall be used. High-impact methods shall be used only on fires that threaten human life and property and riparian resources.

Management Intensities

The following management intensities may be applied.

3. If suppression efforts are within .5 mile of an active bald eagle nest during the nesting season, they shall be based on minimizing the disturbance time to bald eagles. Fire camps should be located at least 1 mile from active nests.

4. Prescribed fire may be used to reduce hazardous fuel accumulations. Burning prescriptions will be consistent with management strategy objectives.

Management Intensities

The following management intensities may be applied.

Management Area 9A
Bald Eagle Nest Sites and Recovery Sites

Goal

This management intensity is designed to maintain, enhance, and provide bald eagle nest sites. Some of these nest sites may also provide winter roosting habitat.

Description

This management intensity may be applied to lands where there are nesting bald eagle pairs or areas identified as bald eagle recovery nest sites.

Desired Future Condition

The desired future condition is multistoried stands of mixed conifer, ponderosa pine and associated species, and ponderosa pine that may provide bald eagle nesting habitat and communal winter roosting habitat. Ponderosa pine, Douglas-fir, and sugar pine are the major preferred tree species. The upper canopy level is comprised of large diameter trees with open upper crowns and large horizontal branches. A component of large trees also is not yet suitable as nest trees but along with large dead trees provides perching habitat. There may be an intermediate canopy level present that consists of immature trees of the desired species. An understory canopy level of seedlings, saplings, and pole-sized trees provides a visual barrier around nest trees, except within the crown drip line of nest and roost trees.

Nesting habitat will be provided for 32 pairs of bald eagles; this was determined to be the Winema National Forest share of habitat (Draft Pacific States Bald Eagle Recovery Plan 1983).

Intensity-Specific Standards and Guidelines

Wildlife and Fish

1. Nest site implementation guides shall be developed for each of the 32 nest sites by the end of the decade.

2. When a pair of bald eagles establishes a nest in a recovery nest site or any other site, that site will become an existing nest site.

3. Disturbing human activities within .5 mile of an active bald eagle nest site will be discouraged or minimized from January 1 through August 31.

4. If a pair of bald eagles chooses to establish a new nest in an area already receiving human use, the human activities occurring at that time should be evaluated for continuance.

5. Nest sites will be at least 125 acres. Nest site areas may vary from 125 acres to 620 acres; the size depends on such factors as topography, eagle use patterns, and proximity of existing land uses near the nest site.

6. There will be 20 percent to 40 percent crown closure of the upper canopy level.

Timber

1. Timber harvest shall not be programmed.

2. Multistoried stands within .25 mile of established nest trees shall be considered for uneven-aged management to maintain or to enhance bald eagle nesting habitat.

Facilities

1. Existing Forest Service roads within .5 mile of active nests should be closed during the January 1 to August 31 nesting season.

2. New road networks shall be designed to facilitate easy control of access during the bald eagle nesting/roosting seasons.

Minerals and Energy

1. New salable mineral material sources shall not be developed, and existing developments shall not be expanded.

2. Except for road access, surface occupancy shall not be allowed.

Management Area 9B
Bald Eagle Replacement Habitat

Goal

This management intensity is designed to develop and enhance replacement habitat for bald eagle nesting, roosting, and perching needs in the event of catastrophic loss of existing nesting, roosting, and perching habitat.

Description

This management intensity may be applied to lands adjacent to existing and recovery nest sites or to other potentially suitable nesting and roosting habitat.

Desired Future Condition

The desired future condition is multistoried stands of mixed conifer, ponderosa pine and associated species, and ponderosa pine that may provide bald eagle nesting habitat and communal winter roosting habitat. Ponderosa pine, Douglas-fir, and sugar pine are the major preferred tree species. The upper canopy level is comprised of large diameter trees with open upper crowns and large horizontal branches.

A component of large trees also is not yet suitable as nest trees. An intermediate canopy level of immature trees of the desired species may exist. An understory canopy level of seedlings, saplings, and pole-sized trees provides a visual barrier around potential nest trees.

Intensity-Specific Standards and Guidelines

Wildlife and Fish

1. When a pair of bald eagles establishes a nest in a replacement stand, that stand shall become an additional nest site and shall be managed according to the standards and guidelines for Management Area 9A.

2. Replacement stands shall be developed and managed to occur on at least 50 percent of each contiguous 40-acre tract to ensure uniform distribution of habitat throughout the management area.

3. The upper canopy level of a replacement stand shall contain five to 10 trees per acre that exhibit the following characteristics:

   a) Have large open upper crowns and large horizontal branches;
   b) Are in the group of preferred tree species; and
   c) Are a minimum of 36 inches DBH and an average of 42 inches DBH or larger.

   The upper canopy levels of a nest site also will have five to 15 trees per acre that have the following characteristics: have the potential to develop open upper crowns and large horizontal branches, are in the group of preferred tree species, and are a minimum of 24 inches DBH and an average of 28 inches DBH.

4. There will be 20 percent to 40 percent overstory crown closure in nest sites.

Timber

1. Timber harvest will be programmed.

Management Area 9C
Bald Eagle Winter Roosting Habitat

Goal

This management intensity is designed to maintain and enhance communal winter roosting habitat for bald eagles.

Description

This management intensity shall be applied to lands where communal roosting by bald eagles occurs.

Desired Future Condition

The desired future condition is stands of Douglas-fir and ponderosa pine with two or more canopy levels. The upper canopy level is comprised of large diameter trees with open upper crowns and large horizontal branches. The understory canopy level is comprised of seedlings and saplings.

b) Timber types other than mature lodgepole pine where treatment can be delayed;

c) General forest areas that are unsuited for harvest but meet the hiding needs in Wildlife and Fish Guidelines 1a or 1b;

d) Existing harvest units or portions of the units that meet or will meet the hiding requirements in Wildlife and Fish Guidelines 1a and 1b within the contract period (in these areas, precommercial thinning may need to be delayed); and

e) Partially treated stands in a proposed timber sale that will still provide hiding conditions meeting the requirements of Wildlife and Fish Guidelines 1a and 1b.

7. To achieve greater age-class diversity in the future, residual stands should be retained where the option exists; foregoing "whip" cutting is necessary.

8. Reductions in open-road density may be used to offset reductions in hiding cover to achieve habitat effectiveness objectives for implementation units.

9. Arrangement of cover areas into corridors is a preferred condition that will be achieved where possible, but will not prohibit accomplishment of timber management objectives. If necessary, the integrity of corridors will be maintained by connecting cover areas with units meeting the requirements in Wildlife and Fish Guideline 1b.

Management Area 13 - Research Natural Areas

Goal

Management Area 13 provides for the preservation of undisturbed forest and rangeland ecosystems for scientific and educational purposes.

Description

Research natural areas (RNA) are part of the network of field ecological research areas for nonmanipulative and nondestructive research, observation and study. Three RNAs will be expanded or established on the Forest: Blue Jay, Cannon Well, and Cherry Creek. These RNAs include the following cells:

Blue Jay	(Existing) ponderosa pine/bitterbrush/needlegrass and lodgepole pine/bitterbrush/needlegrass plant communities on pumice soils. (Addition) Bluegrass-wheatgrass meadow and lodgepole pine/bitterbrush-bearberry/needlegrass plant communities.
Cannon Well	(Establish) Lodgepole pine/bitterbrush/needlegrass and lodgepole pine/needlegrass basin.
Cherry Creek	(Establish) Mixed conifer forest with snowberry and green manzanita, mixed shasta red fir and mountain hemlock, lodgepole pine/grouse huckleberry, high-elevation lake, permanent subalpine ponds, vernal ponds at high elevation, sedge fen, and a first to third order stream system.

Desired Future Condition

The desired future condition is an essentially unmodified area.

Standards and Guidelines

There is only one management intensity for this management area. Specific standards and guidelines that apply to this management area are stated in this subsection.

A research natural area establishment report shall be developed for each potential area. A management plan and monitoring plan will be developed for each area once it is established as a research natural area.

Recreation

1. The area shall provide a roaded natural or semiprimitive recreation opportunity.

2. Physical improvements for recreation purposes like buildings or campgrounds shall not be constructed in these areas.

3. Dispersed recreation is a compatible use to the extent that it does not reduce the research or educational values for which the area was established.

Scenic

1. The visual quality level will be preservation.

Wilderness

1. Wildernesses shall take precedence where they overlap with RNAs, because land use regulations are generally more restrictive in wilderness. Management plans for wildernesses shall address overlaps with RNAs.

Wildlife and Fish

1. New wildlife habitat improvements shall not be allowed.

Range

1. Domestic livestock grazing shall be excluded from established research natural areas unless grazing is needed to preserve the existing plant communities.

Timber

1. Timber harvest shall not be allowed.

Minerals and Energy

1. Salable mineral material sources shall not be developed.

2. All established research natural areas on public domain lands shall be recommended for withdrawal from mineral entry under the General Mining Law of 1872, as amended.

3. Surface occupancy shall not be allowed.

4. Personal use or commercial firewood cutting permits shall not be issued for these areas.

Native American Rights and Claims

1. Under the Treaty of 1864, the Klamath Tribe's rights to traditional food gathering activities shall apply to established research natural areas within the jurisdiction of the treaty, but shall not be encouraged.

Lands

1. Landownership classification group 2 applies to this management area.

2. Special-use permits shall be limited to research and related activities.

3. Easements or rights-of-way shall not be granted.

4. Utility and transportation corridors shall not be allowed.

Facilities

1. Any transportation facilities, such as roads and trails provided for this management area, shall have minimum impacts on the area ecosystems, and must be located and managed in the best way to fulfill the area's management objectives.

2. Helispots needed for fire control shall be located adjacent to, and not within, research natural areas.

Protection

1. Insect and disease outbreaks shall not be suppressed.

2. Using means that will cause minimal damage to the area, wildfires that endanger the RNA will be extinguished as quickly as possible.

3. Prescribed fire and fuels treatment shall be carried out only in conjunction with approved research projects or when needed to meet the RNA management plan objectives.

Management Area 15 - Upper Williamson

Goal

Management Area 15 provides a natural-appearing forest setting for dispersed recreation activities and special wildlife habitats.

Description

This management area applies to the historical Klamath Tribe use areas along the Upper Williamson River and along the Klamath Forest Marsh.

Desired Future Condition

The desired future condition is a slightly altered forest environment, including a mix of native coniferous and deciduous trees and shrubs. There is a generally uniform appearing forested environment with a variety of age classes throughout the ponderosa pine working group. Cutting units will dominate in the lodgepole pine working group.

Standards and Guidelines

Recreation

1. The area shall be managed to provide a roaded natural to roaded modified recreation opportunity setting.

2. Special use permits may be permitted for traditional tribal camping over extended periods.

3. Low-key interpretative facilities may be provided in special wildlife and historic areas, particularly around the Klamath Forest Marsh.

Scenic

1. Scenic management activities shall generally achieve the foreground partial retention visual quality level. However, the foreground of the Williamson River will generally achieve the retention visual quality level.

2. Evidence of management activities (such as tree removal and slash disposal) along roads will not be visible three years after the work is completed.

Wildlife and Fish

1. The portions of this management area along the edge of the Klamath Marsh shall be managed to produce larger diameter (36 inches DBH or greater), open-canopied, long-limbed ponderosa pine and Douglas-fir for replacement bald eagle nesting habitat.

2. Fish and waterfowl habitat improvement will be emphasized in riparian areas adjacent to this management area.

Timber

1. Timber harvest shall be programmed.

2. Uneven-aged management systems shall be used in the ponderosa pine and pine associated working groups. A variety of sizes up to 30 inches DBH will remain after harvest, except in areas of foreground retention and eagle replacement where a 36-inch DBH size class shall remain after harvest.

3. Uneven-aged management silvicultural systems may be used to manage the lodgepole pine working group if it is deemed optimal during project-level planning. A variety of size classes up to 12 inches DBH will be retained after an uneven-aged harvest entry.

4. Stocking levels may be varied to meet other resource needs.

Lands

1. Landownership classification group 2 applies to this management area. Acquisition of private lands should be directed at obtaining fish and wildlife habitat and access for the recreating public. The Forest shall also consider acquisition of less than fee title to meet landownership objectives.

2. This is an avoidance area for new transportation and utility corridors.

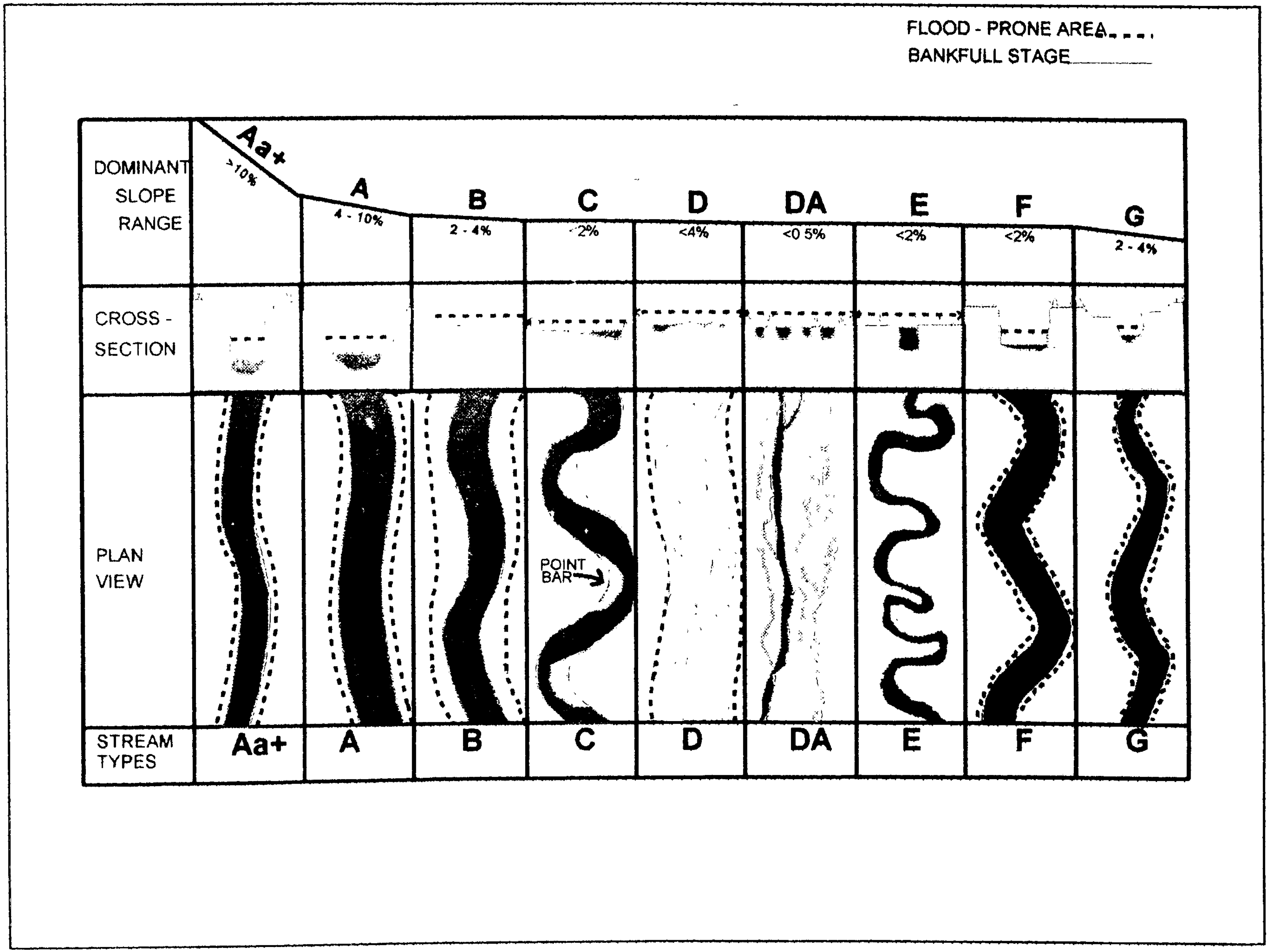
Protection

1. In areas along roads, wood residues from stand management activities may be present in low levels, such as an occasional large down log and scattered branches that appear natural. Slash should be piled and burned in areas of low visibility, and low impact methods should be used. Uprooted stumps are not desirable, and should be removed unless they are blended to appear natural in the landscape.

APPENDIX

B

Longitudinal, cross-sectional, and plan views of major stream types (after Rosgen 1994)



APPENDIX

C

ANALYSIS OF CHANNELS IN THE HEADWATERS AND WILDHORSE SUBSHEDS

Assessment of the following systems was made by examining all accessible road crossings. Any systems with a channel defined by more than a litter layered low area were examined more closely to determine classification and riparian component if present. All length and slope values have been determined from USGS Quadrangles. All the systems listed were rated as PFC or FAR. The most common risk factor appears to be the number of road crossings and only a small fraction of those are visibly contributing negatively to the stream channels. One other risk factor that commonly occured was the effects of past logging activity. Many of the cuts examined extended up to and through existing or once existing stream channels. It is not clearly evident whether removal of shade and disregard for existing stream channels, during logging operations, has caused the loss of or a change to a drier riparian plant community in some systems.

T1AR1 (T33/34SR10E) This .39 mi. reach originates from Willow Pond and continues across forest road 410 downstream to its confluence with T35. Map calculated slope is 1.13%. Channel is mostly undefined, non-riparian, and ephemeral. This reach does contain a segment that is riparian. This segment extends from the 410 road west to the channel origin. This area consists of a dense salix community. No surface water is present but the water table is very near the surface. Possibly the result of the 410 road acting as a compression dam and hindering ground water flow beyond its limit. System appears to be in proper functioning condition. RISKS: 410 road xing.

T35AR1 (T33SR11E) This 1.02 mi. reach extends from its sub-out point in sec. 6 upstream to the confluence of T35 and T24, just north of the Williamson River Highway. Map calculated slope is 1.05%. Channel is mostly defined, non-riparian, and ephemeral. In places recent vehicle traffic is evidenced directly in the channel.

T35AR2 (T33SR11E) Reach is 2.57 mi. in length and extends from the confluence with T24 vic. of the Williamson River Highway upstream through sec.18 and 19 to confluence with T29. Map calculated slope is 1.74%. Channel is well defined with a pebble to cobble substrate. Braiding takes place where the channel becomes less confined between side slopes. There is no riparian plant community and the system is classified as ephemeral. System is in proper funtioning condition with no apparent risks other than possible upstream activities.

T35AR3 (T33SR11E) This 1.01 mi. reach extends from the confluence with T29 in sec.19 upstream to the 4592 road (vic. Wildhorse Spring). Map calculated slope is .84%. Channel is clearly defined and intermittent with a riparian plant community of (CLM2-11) lodgepole/bearberry. System could easily be classified as PFC but the 4592 road crossing is contributing excess sediment directly to the stream channel and sediment from the road crossing is evidenced appx. 100ft. downstream. Logging or firewood gathering operations in the area between this trib and the Wildhorse spring channel appear to be having a more detrimental effect on the riparian community than road conditions. System is rated FAR downward trend.

T35AR4 (T33SR10/11E) This 2.04 mi. reach extends from the 4592 road xing upstream to the confluence of T1. Map calculated slope is 2.19%. Channel is mostly defined, non-riparian, and ephemeral. Most of this system is in proper functioning condition. RISK. vehicle traffic from the 4592 road has utilized the channel in the upstream direction apparently during firewood gathering activities.

T35AR5 (T33SR10E) Unable to locate any definable channel for this tributary. Map calculated length .87 mi. and slope .15%.

T35BR1 (T33SR10E) This reach, as mapped, is .23 mi. long with a map calculated slope of .42%. Trib should be mapped at least to and more likely beyond the 330 road where there is no definable channel but a riparian community of (CLM2-11) lodgepole/bearberrry. Riparian vegetation presence indicates an intermittent system. System is in proper functioning condition but possible risks may include the 330 road xing and past logging activity.

T35CR1 (T33SR10E) This reach, like T35B, should be mapped at least to or beyond the 330 road xing. It is currently mapped as being .28 mi. in length with a .14% slope. Channel is undefined and intermittent with a riparian plant community of (CLM2-11) lodgepole/bearberry. System is in proper functioning condition again with possible risks from the 330 road xing and past logging activity.

T29AR1 (T33SR11E SEC 29) This intermittent reach is .85 mi. long from its confluence with T35A upstream to its origin. Map calculated slope is 1.0%. Channel is defined and a riparian plant community of (MD19-11) Poa cusickii exists. System is functioning at-risk. Risk factors include the 460 road xing and, more importantly, past logging activity.

T25CR1 (T33SR10/11E SEC25/30) This unmapped reach originates at Wildhorse Spring and joins T35AR3 appx. .25 mi. downstream from the 4592 road xing. Channel is well defined, riparian (GM41-12 Elymus glaucus), and perennial. Channel morphology is similar to T35AR3. System was still flowing water up to but not beyond the confluence with T35A in mid August 95. System appears to be in proper functioning condition but there is some very noteworthy gullying taking place down the 4592 road and contributing sediment directly to the channel. Also, logging or firewood gathering activities between T25 and T35 are having negative effects on the riparian community.

T24AR1 (T33SR10/11E SEC 7/18/24) This reach is 2.41 mi. long with a map calculated slope of 3.2%. It extends from its confluence with T35A upstream across the Will. Riv. Hwy. to its origin in Sec. 24. Channel is mostly undefined, non-riparian and ephemeral except just upstream from the Williamson River Highway. Here more of a riparian plant community is evident but likely the result of water being held back for a longer period of time by the highway. System is rated as functioning at risk. This tributary is crossed by forest roads at least 7 times throughout its length and past logging activity has occured up to and through the existing channel.

T13AR1 (T33SR10E SEC12/13) This reach extends from its origin near the jct. of forest road 055 and the Will. Riv. Hwy. to its sub-out point at the southwest corner of Deer Draw. Map calculated length and slope is 1.11 mi. and 4.49%. Channel is mostly defined, non-riparian, and ephemeral. System is in proper functioning condition with the only risks possibly posed by the 4590 and 020 road xings.

WRMR1 (T33SR11E SEC 9) This reach extends from the private property boundry near the Head of the River Campground upstream to the confluence of T11A. Map calculated length is .75 mi. and slope is 2.19%. Channel is defined, non-riparian and ephemeral. System is rated as properly functioning.

WRMR2 (T33SR11E SEC 9) This reach extends from the confluence of T11A upstream to the 44 road xing. Length .47 mi. and slope 3.65%. Channel is mostly undefined, non-riparian, and ephemeral. Proper functioning condition.

WRMR3 (T33SR11E SEC 14/15) This reach extends from the 44 road xing upstream to the confluence of T13A. Map calculated length is 1.62 mi. and slope is 1.75%. Channel is mostly undefined, non-riparian, and ephemeral. Proper functioning condition.

WRMR4 (T33SR11E SEC 14/23/24) This reach extends from the confluence of T13A upstream to the confluence of t25A in Sec 24. Map calculated length is 2.38 mi. and slope is .68%. Channel is mostly undefined, non-riparian, and ephemeral. Proper functioning condition.

WRMR5 (T33SR11E SEC 24) This reach extends from the confluence with T25A upstream to the confluence with T19A (vic. Bottle Spring). Map calculated length is .81 mi. and slope is .82%. Channel is defined, riparian (MD19-11 Poa cusickii), and intermittent. Despite some disturbance via the 110/170 road xing near the stock pond in Sec 24 and activity in the meadow, this system is in proper functioning condition.

NOTE: There is a reach extending north from the meadow above the stock pond in Sec 24 that is unmapped. Channel is undefined, but a (CLM2-11) lodgepole/bearberry riparian community exists.

WRMR6 (T33SR11/12E SEC 18/19/24) This reach extends from the confluence with T19A (vic. Bottle Spring) upstream to its origin above an unnamed spring in Sec 18. Map calculated length is 1.14 mi. and slope is 1.49%. Channel is defined, riparian (HQM1-21 Aspen/Elymus glaucus) and intermettent. Rated as properly functioning but risks posed again by road xings (4650, 100, and an unnamed road).

T13AR1 (T33SR11E SEC 13/14) This reach extends from its confluence with WRMR3 upstream to its origin in Sec 13. Map calculated length is 1.08 mi. and slope is 2.35%. Channel is mostly defined, riparian (GM41-12) and intermittent (more so in the upstream direction). Proper functioning condition. RISKS: 110 road xing.

T14AR1 (T33SR11E SEC 14) This reach extends from its confluence with T13A upstream to its origin. Map calculated length is .77 mi. and slope is 3.2%. Channel is mostly defined, riparian (CLM2-11) and intermittent. An unmapped stock pond exists on the upstream side of the 110 road xing in a meadow. Meadow consists of (MD19-11) Poa cusickii with

Calochartus longebarbatus (sensitive plant species). System is in proper functioning condition. RISKS: 110 road xing.

T25AR1 (T33SR11E SEC24/25) This reach extends from its confluence with WRMR4 upstream to its origin in Sec 25. Map calculated length is 1.17 mi. and slope is 1.13%. Channel is mostly undefined, non-riparian and ephemeral. Proper funcitoning condition. RISKS: 4652 road xing.

T19AR1 (T33SR11/12E SEC19/24) This reach extends from its confluence with WRMR5 upstream to its origin in Sec 19 (vic. Pelican Reservoir). Map calculated length is 1.07 mi. and slope is 1.24%. Channel is mostly undefined, non-riparian and ephemeral. Proper functioning condition.

T11AR1 (T33SR11E SEC 9/10/11) This reach extends from its confluence with WRMR1 upstream to its origin in Sec 11. Map calculated length is 1.37 mi. and slope is 3.04%. Channel is mostly undefined, non-riparian and ephemeral. Proper functioning condition.

T18AR1 (T33SR11E SEC 11/12) This reach extends from its sub-out point in Sec 11 upstream to the confluence with T12A. Map calculated length is .93 mi. and slope is 1.22%. Channel is undefined, non-riparian, and ephemeral. Proper functioning condition.

T18AR2 (T33SR11E SEC 12) This reach extends from the confluence with T12A upstream to the confluence with T7A. Map calculated length is .37 mi. and slope is 2.38%. Channel is undefined, non-riparian, and ephemeral.

T18AR3 (T33SR11/12E SEC 12/13/18) This reach extends from the confluence with T7A upstream to its origin in Sec 18. Map calculated length is 1.05 mi. and slope is 1.03%. Channel is mostly undefined, non-riparian and ephemeral however, there are intermittent, riparian inclusions of (CLM2-11) lodgepole/bearberry, specifically at the border of Sec 13/18 where the channel nears the 223 road.
Proper functioning condition.

T7AR1 (T33SR11E SEC 7/12) This reach extends from its confluence with T18A upstream to its origin in Sec 7. Map calculated length is .57 mi. and slope is .76%. Channel is undefined, non-riparian, and ephemeral. Proper functioning condition.

T12AR1 (T33SR11E SEC 12) This reach extends from its confluence with T18A upstream to its origin in Sec 12. Map calculated length is .14 mi. and slope is 2.71%. Channel is undefined, non-riparian and ephemeral. Proper functioning condition.

T12AR2 (T33SR11/12E SEC6/12) This reach extends from its sub-out point in Sec 12 upstream to its origin in Sec 6. Map calculated length is .86 mi. and slope is 4.83%. Channel is undefined, non-riparian and ephemeral. Proper functioning condition.

T36AR1 (T33SR11E SEC3/4) This reach extends from Yamsey Springs area (Head of the River Campground) upstream to the confluence with T25B. Map calculated length is 1.39 mi. and slope is 3.15%. Channel is mostly undefined, non-riparian and ephemeral. Downstream from the 4648 road the channel does become more defined and some riparian vegitation is present. Proper functioning condition. RISKS: at least 4 different road xings.

T36AR2 (T33SR11E SEC 2/3) This reach extends from the confluence with T25B upstream to the private property boundry in Sec 2. Map calculated length is 1.52 mi. and slope is 4.55%. Channel is undefined, non-riparian and ephemeral. Proper functioning condition. Only apparent risks may be posed by road xings (at least 4).

T25BR1 (T33SR11E SEC 3) This reach extends from its confluence with T36A upstream to the private property boundry in Sec 3. Map calculated length is .54 mi and slope is 4.05%. Channel is undefined, non-riparian and ephemeral. Proper functioning condition.

FUNCTIONAL CONDITION AND PERIODICITY OF CHANNELS IN THE HEADWATERS AND WILDHORSE SUBSHEDS

LEGAL	REACH	DEFINABLE CHANNEL	RIPARIAN COMMUNITY	PERIODICITY	CONDITION	RISKS
			HEADWATERS OF THE WILLIAMSON RIVER SUBSHED			
T33SR11ES9	WRMR1	Y		EPH	PFC	A
T33SR11ES9	WRMR2	N		EPH	PFC	
T33SR11ES14/15	WRMR3	N		EPH	PFC	
T33SR11ES23/24	WRMR4	N		EPH	PFC	
T33SR11ES24	WRMR5	Y	MD19-11	INT	PFC	A
T33SR11ES18/19	WRMR6	Y	HQM1-21	INT	PFC	A
T33SR11ES24	T24AR1	N		INT/PER	PFC	
T33SR11/12ES19/24	T19AR1	N		EPH	PFC	
T33SR11/12ES24/25	T25AR1	N		EPH	PFC	A
T33SR11ES13/14	T13AR1	Y	GM41-12	INT	PFC	A
T33SR11ES14	T14AR1*	Y	MD19-11	INT	PFC	A
T33SR11ES9/10/11	T11AR1	N		EPH	PFC	
T33SR11ES11/12	T18AR1	N		EPH	PFC	
T33SR11ES12	T18AR2	N		EPH	PFC	
R33SR11/12S12/12/18	T18AR3	N	CLM1-12	INT	PFC	A
T33SR11ES7/12	T7AR1	N		EPH	PFC	
T33SR11ES12	T12AR1	N		EPH	PFC	
T33SR11/12ES6/12	T12AR2	N		EPH	PFC	
T33SR11ES1/2	T2AR1	?		?	?	?
T33SR11ES3/4	T36AR1	N		EPH	PFC	A
T33SR11ES2/3	T36AR2	N		EPH	PFC	A
T33SR11ES3	T25BR1	N		EPH	PFC	

*Area contains sensitive plant species Calochortus longebarbatus

LEGAL	REACH	DEFINABLE CHANNEL	RIPARIAN COMMUNITY	PERIODICITY	CONDITION	RISKS
			WILDHORSE CREEK SUBSHED			
T33SR11ES6/7	T35AR1	Y		EPH	PFC	
T33SR11ES7/18/19	T35AR2	Y		EPH	PFC	
T33SR11ES9/30	T35AR3	Y	CLM2-11	INT	FAR	A,G
T33SR10/11ES36/25	T35AR4	Y		EPH	PFC	A
T33SR10ES35/36	T35AR5	?				
T33SR10ES1/36	T1AR1	N		EPH	PFC	A
T34SR10ES1/2	T1AR2	N	SALIX	INT	PFC	
T33SR10ES35	T35BR1	N	CLM2-11	INT	PFC	A,G
T33SR10ES35	T35CR1	N	GM41-12	INT	PFC	A,G
T33SR11ES29	T29AR1	Y	MD19-11	INT	FAR	A,G
T33SR10/11ES25/30	T25CR1	Y	GM41-12	PER	FAR	A,G
T33SR10/11ES7/24	T24AR1	Y		EPH	FAR	A
T33SR10ES12/13	T13AR1	Y		EPH	PFC	

REACH DESIGNATION e g T11BR2DRI

T11	-	Tributary with headwaters in section 11
B	-	Indicates this is the second tributary originating in section 11
R2	-	Reach number two in upstream direction from confluence of next larger tributary
D	-	Definable (D) channel as opposed to an Undefined (U) channel
R	-	Indicates an in-channel Riparian (R) plant community as opposed to a Non-riparian (N) plant community
I	-	Intermittent (I) as opposed to Ephemeral (E) or Perennial (P)

FUNCTIONAL CONDITION

PFC	-	Proper Functioning Condition
FAR	-	Functional At Risk
U	-	Upward Trend
D	-	Downward Trend
NA	-	Trend Not Apparent
NF	-	Non-Functional

AT-RISK FACTORS COMMONLY ENCOUNTERED

A	Road activity contributing negatively
B	Presence of Active Headcuts
C	Side bank erosion
D	Side slope erosion
E	Presence of Increaser/Invader vegetative species
F	Loss of Riparian Zone/Floodplain
G	Past Logging Activity
H	Manmade Diversions/Channelization
I	Mixed effects from past Erosion Control Structures

APPENDIX

D

CHILOQUIN DISTRICT SOIL COMPACTION MONITORING DATA SUMMARY

Unit Name	Draw LP Unit 5	Draw LP Unit 10	Bull Unit 8
Soil Type	A6G2	B8G1	B7G1
Samples Tested	98	100	98
Samples Required	53	75	62
Sample Mean Db (g/cc)	.71	.67	.66
Controls Mean Db	.67	.63	.74
Sample Mean (-) Control Mean	.04	.04	.08
Control Mean (+) 20% (UUL)	.81	.76	.80
# Sample exceeding UUL	4	16	16
% Detrimental Compaction	4.08%	16.00%	16.33%

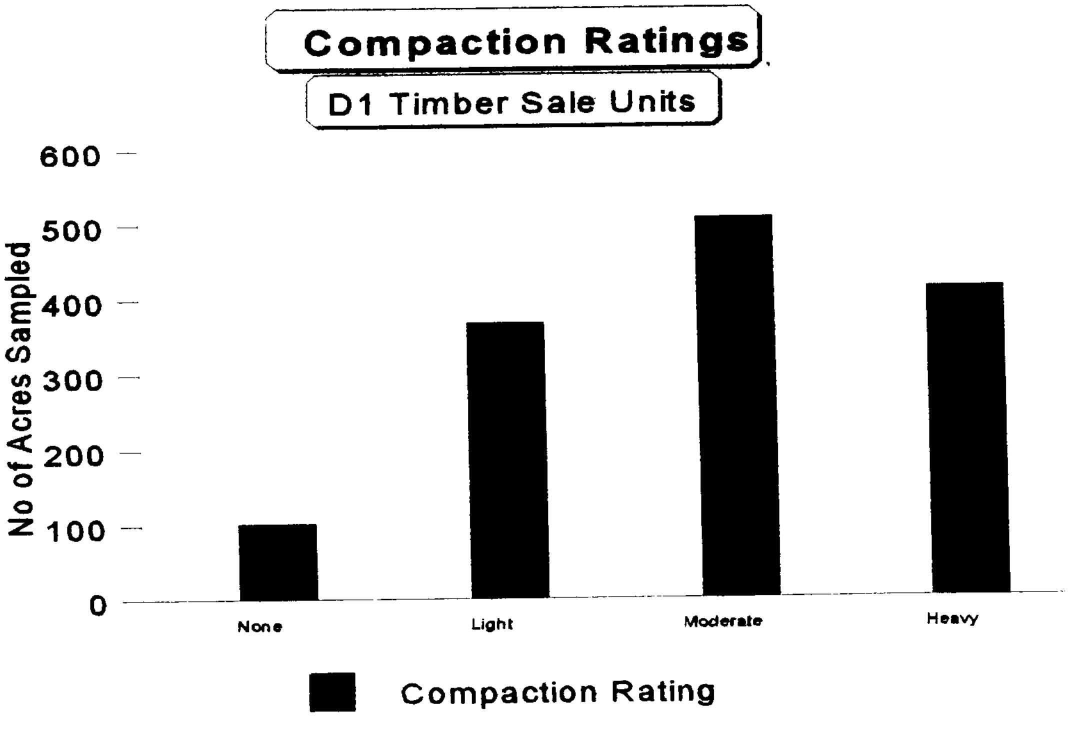
Db = Bulk Density
UUL = Upper Undisturbed Limit

Chemult District Soil Compaction Ratings on Timber Sale Units

UNIT	ACRES	RATING 0	RATING 1	RATING 2	RATING 3	COMB 0 + 1	COMB 2 + 3
Wooly 2	45	20%	43%	18%	19%	63%	37%
Wooly 7	61	7%	40%	34%	18%	47%	52%
Wooly 10	58	17%	28%	30%	25%	45%	55%
Wooly 11	53	4%	41%	39%	17%	45%	56%
Wooly 12	49	20%	37%	32%	11%	57%	43%
Wooly 14	44	2%	34%	43%	22%	36%	65%
Wooly 16	57	4%	17%	31%	49%	21%	80%
Wooly 18	88	9%	34%	42%	15%	43%	57%
Wooly 19	60	14%	37%	26%	23%	57%	49%
Sheep 1	139	3%	21%	44%	33%	24%	77%
Sheep 6	73	7%	36%	48%	9%	43%	57%
Little Skeeter 5	99	7%	26%	25%	42%	33%	67%
Little Skeeter 6	83	10%	17%	40%	34%	27%	74%
Little Skeeter 9	72	3%	26%	45%	26%	29%	61%
South Jackson 5	101	4%	19%	50%	27%	23%	77%
South Jackson 11	46	2%	22%	44%	32%	24%	76%

UNIT	ACRES	RATING 0	RATING 1	RATING 2	RATING 3	COMB 0 + 1	COMB 2 + 3
Narrow 2	74	5%	26%	43%	26%	31%	69%
Upper Modoc 1	42	5%	24%	38%	33%	29%	71%
Upper Modoc 2	46	6%	23%	39%	32%	29%	71%
Schooner 9	40	20%	23%	31%	26%	43%	57%

Compaction Rating 0 = None (No Change from undisturbed soil bulk density)
Compaction Rating 1 = Light(bulk density = 0.65 to 0.86 g/cc)
Compaction Rating 2 = Moderate(bulk density = 0.87 to 0.98 g/cc)
Compaction Rating 3 = Heavy (bulk density = 0.99g/cc or greater)
Compaction Rating percentages added together for "0+1" and "2+3"
Rating Percentages = % of acres in Timber Sale Unit with a 0, 1, 2, 3, 0+1, 2+3 rating
Ex. Schooner 9, 40 acres x 20% (0 Rating) = 8 acres w/no compaction in this unit.
Note: Probe results were accurate 86% of the time when compared to actual soil samples.



APPENDIX

E

A SHORT HISTORY OF WILLIAMSON RIVER HABITAT IMPROVEMENT PROJECTS

The following information was provided by Tom Neal, representing Klamath Flycasters; John Fortune, ODFW Fish Biologist; Chris Hescock and Jay Frederick, Biologists on the Chiloquin Ranger District, Winema National Forest.

<u>1973</u>

The Royce Tract was obtained by the Winema National Forest through land exchange. This afforded the opportunity for riparian and instream fish habitat improvement.

<u>1974</u>

Upper Williamson River -- Royce Tract

Project: Tree and shrub planting in fenced exclosures (400 shrubs including poplar, willow, aspen, and Chinese elm on both sides of one mile of stream).

Purpose: To provide shade along stream.

Cooperators: ODFW, USFS, KCFC (Klamath County Flycasters), Boy Scouts.

Success: Largely a failure because the plots were too far above the water table.

<u>1975</u>

Spring Creek (tributary to Lower Williamson River)

Project: Placement of 300 yards of spawining gravel behind gabion.

Purpose: To develop additional spawining habitat for trout.

Cooperators: ODFW, OSPD.

Success: Excellent, trout began using the area in November of 1975.

Upper Williamson River -- Royce Tract

Project: Continuation of tree and shrub planting begun in 1974. (A total of 1200 trees and shrubs were planted and protected by wire cages in 1974 and 1975.)

Purpose: Provide stream shading.

Cooperators: ODFW, USFS, Mazama Flycasters.

40 person hours

Success: Poor because of low watertable. Approximately 35% survived after one year Native vegetation responded well where cattle were excluded.

1976

Upper Williamson River

Project: Fenced 1/2 mile of stream upstream from Rocky Ford to exclose cattle from the stream.

Purpose: To allow for riparian/stream rehabilitation and improve fish habitat.

Cooperators: ODFW on USFS

Success: Good, showing slow recovery, has suffered from trespass cattle grazing.

1977

Upper Williamson River

Project: Riprap eroding streambanks on Royce Tract. Lodgepole pine trees placed parallel to the banks. 150 willows and 50 aspen shoots planted along stream edge.

Purpose: To slow velocity and capture sediment.

Cooperators: ODFW, USFS

Success: Partial. Some protection and rehabilitation. Problems with beavers stripping limbs off trees and eating planted willows and aspen shoots. Trespass cattle caused problems and reduced success.

1978

Spring Creek (tributary to Lower Williamson River)

Project: Placed 50 yards of grabel in channel. Added 200 yards of gravel to gabion.

Purpose: To probide new and better spawining habitat for trout.

Cooperators: ODFW, OSPD, KCFC may have helped purchase gravel.

Success: Excellent. Heavily used by large spawning trout.

1979

Spring Creek (tributary to Lower Williamson River)

Project: Placed 60 yards of gravel instream.

Purpose: To enhance trout spawning habitat.

Cooperators: OSPD, Winema N. F., FFF, ODFS, KCFC

KCFC: 5 person for 30 person hours
FFF, ODFW: $500 toward purchase of gravel
USFS:

Success: Excellent.

1980

Spring Creek (tributary to Lowere Williamson River)

Project: Placed 50 yards of grabel in stream.

Purpose: Provide additional spawning habitat.

Cooperators: ODFW, KCFC

KCFC: 10 person for 50 person hours.
ODFW: gravel purchased in 1979.

Success: Excellent.

1981

Upper Williamson Fiber -- Royce Tract

Project: Placement and anchoring to banks of 52 lodgepole pine trees.

Purpose: To deflect flow from eroding banks and provide xover for trout.

Cooperators: ODFW, USFS

2 days

Success: Fair. Provided bank protection enhancing riparian recovery and providing cover for fish.

1984

Spring Creek (tributary to Lower Williamson River)

Project: Placement of 96 yards of gravel.

Purpose: Enhance spawning habitat for trout.

Cooperators: ODFW (STEP), OSPD, KCFC

7 person for 54 person hours, $264 donations to KCFC for purchase of gravel.

Success: Excellent.

1986

Upper Williamson River -- Royce Tract

Project: Planted willow wattles and stakes along waterline.

Purpose: To establish and accelerate streamside cover.

Cooperators: ODFW, USFS, Klamath Tribe (KT), KCFC

KCFC: 8 person for 64 person hours>

Success: Minimal. Very little survival of plantings due to beaver activity and frost heave.

1987

Upper Williamson River -- between Sand Creek Ranch and Deep Creek

Project: Placement of 325 trees along 1.7 miles of stream.

Purpose: To accelerate rehabilitation of stream and improve fish habitat.

Cooperators: ODFW, USFS, YCC, KT, KCFC.

KCFC: 125 person hours.

Success: Excellent. Structures deflecting current and trapping sediment, narrowing stream and providing fish cover.

Spring Creek (tributary to Lower Williamson River)

Project: Placement of 3 log sills with gravel.

Purpose: To enhance trout spawning habitat as mitigation of brown trout die-off as result of fire retardent drop in stream.

Cooperators: ODFW, YCC, KCFC

ODFW, YCC: approx. 28 person hours
KCFC: 14 person hours
USFS: Funding for gravel purchase through KV funds from fire salvage sale.

Success: Good.

Upper Williamson River -- Deep Creek area

Project: Continuation for tree placement in the Deep Creek area on 0.8 miles of stream.

Purpose: To narrow stream channel and provide better cover.

Cooperators: ODFW, YCC, USFS, KCFC

ODFW, YCC: approx. 80 person hours
KCFC: 8 members participated 40 person hours
USFS:

Success: Excellent, working as intended.

Lower Williamson River -- Larkin Creek to Collier State Park

Project: Placement of boulders, trees and trees with root wads.

Purpose: To provide instream cover.

Cooperators: ODFW, USFS, KCFC, Roy Hauck Construction

ODFW: approx. 80 person hours
KCFC: 40 person hours
USFS:
Roy HauckConstruction: Hauled trees from HWY 97 right of way constructionto stream side.

Upper Williamson River -- Royce Tract and other portions

ODFW, KT, and Winema N. F. enter into cooperative monitoring effort which consists of 8 river cross-sections recording velocity, depth, and width; and 24 photo points to determine changes in the river system. The report will be due in the year 2000.

1989

Lower Williamson River -- mouth or Kirk Canyon

Project: Placement of 35 yards of gravel in spring areas.

Purpose: To enhance trout spawning.

Cooperators: ODFW, YCC, USFS, KCFC

ODFW, YCC: approx. 40 person hours
KCFC: 20 person hours
USFS:

Success: Good. Spawning trout were observed using the gravel by early November, 1989.

Lower Williamson River -- Williamson River Campground

Project: Placement of 25 yards of gravel in streambed. Accomplished in November.

Purpose: To enhance trout spawning.

Cooperators: ODFW, KCFC

ODFW: approx 120 person hours
KCFC: 60 person hours

Upper Williamson River -- Royce Tract

Project: Placement of 50 additional trees. This is the last project work in this area, future effort will be to monitoring (see 1988).

Purpose: Streambank stabilization, instream cover.

Cooperators: USFS, ?

USFS: Tractor used to uproot and place trees.
? : Pickup with winch used to help place trees.

1990

Upper Williamson River -- Sand Creek Ranch downstream 2 miles

Project: Removal of old fencing, repared exising fences and ates. Constuected 400 feet of new drift fence. Accomplished in July.

Purpose: Clean up streamside area. Fence constucted to protect spring area.

Cooperators: ODFW, KCFC

ODFW: approx. 120 person hours
KCFC: 60 person hours

1991

Mainstem Williamson River -- Kirk Canyon

Project: Install 10 yards of river washed gravel in main and side channels.

Purpose: Enhance spawning habitat for salmonids.

Cooperators: USFS, ODFW

Success: Not determined.

1993

Upper Williamson River -- Rocky Ford Crossing

Project: Construct 1.8 miles of smooth wire "New Zealand" livestock fence along east side of river. Fence approximately 200 feet from river.

Purpose: Inhibit livestock use of riparian area or create riparian pasture, depending on current political direction.

Cooperators: USFS, ODFW, KCFC

Success: After first year, maintenance level appears low. Fence effectivly inhibits livestock tresspass.

1994

Upper Williamson River

Project: Contruct 1.0 miles of smooth wire livestock fence along east side of river. Fence approximately 400 feet from river. Construct syles for recreational access to river (4).

Purpose: Inhibit livestock use of riparian area.

Cooperators: USFS

Success: Not determined.

Bottle Spring -- Upper Williamson Watershed

Project: Construct 1.6 miles of smooth wire livestock fence around meadow.

Purpose: Regulate livestock use of riparian meadow; protect high quality source of ground water to upper Williamson River.

Cooperators: USFS

Success: Not determined.